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ABSTRACT

The Mathematics Assessment Questionnaire was designed to sample thoughts and feelings of students in grades 7 through 9 in relation to solving mathematical word problems. Test development studies began in 1986-87 with a review of research and literature and the writing of sample statements that were evaluated by 16 experienced teachers and educators. In the 1987-88 academic year, a series of small-scale studies addressed issues related to: (1) metacognitive statements; (2) self-regulatory statements; (3) affective belief; (4) motivation; (5) attribution statements; and (6) usefulness to teachers. In a 1988 pilot study, the revised statements were administered in three forms to 1,557 students in grades 7, 8, and 9 in New York City. The item pool was subsequently revised to retain a model of the domain structure that included both settings and psychological constructs. Analyses were conducted on data for 1,368 respondents. The revised questionnaire was administered in the fall of 1988 to 2,658 students in grades 7, 8, and 9 in New York City public schools. Results from 2,451 students were examined through factor and discriminant analyses to provide information about students' item responses and test reliability. Forty tables and two figures provide data from the development studies. A 30-item list of references is included. The 161-item source questionnaire; the responses for the fall 1988 sample; and statement numbers, scale response numbers for indicators, and interpretation of diagnostic indicators for affective belief, motivation, and attribution categories are appended. (SLD)

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MATHEMATICS ASSESSMENT QUESTIONNAIRE: A SURVEY OF THOUGHTS AND FEELINGS FOR STUDENTS IN GRADES 7 - 9

TECHNICAL REPORT

Deborah Hecht
Carol Kehr Tittle

Research Edition

Center for Advanced Study in Education
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Center for Advanced Study in Education
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CHAPTER I

DESCRIPTION AND PURPOSE

The Mathematics Assessment Questionnaire: A survey of thoughts and feelings, for students in grades 7-9, was developed to provide information which is complementary to that provided by teacher assessments or standardized tests of mathematical concepts and procedures. The Mathematics Assessment Questionnaire, MAQ, is designed to sample students' thoughts and feelings in relation to doing and learning a particular process of mathematics -- solving mathematical word problems. The facets or dimensions used to design the questionnaire are:

1. Mathematical content,
2. Psychological construct, and
3. Classroom related learning or activity setting.

The first facet, the mathematical content, is the same in all statements--mathematical word problems. The second facet, the psychological construct, focuses upon students' thoughts and feelings. It includes metacognitive activities, self-regulatory activities, and affective beliefs, motivations and attributions. The third facet, the activity setting, includes three mathematics classroom-related situations during which students engage in problem-solving: during classroom instruction, while working with other students in a group, and while doing homework. With the exception of the Metacognitive statements in Part I of the MAQ, each MAQ statement examines a psychological construct related to solving or learning mathematical word problems within the context of one of the three activity settings -- During Class, Working With Other Students, or Doing Homework.

The Mathematics Assessment Questionnaire is concerned with one of the educational outcomes of schools--developing knowledge about mathematical concepts and procedures as applied in the process of solving word problems. This outcome is placed in the context of the thoughts and feelings that students have about doing mathematical word problems in several classroom activity settings. The MAQ includes statements that are related to the "mathematical dispositions" of students, as described in the Curriculum and Evaluation Standards for School Mathematics of the National Council of Teachers of Mathematics (1989, p.233).

The Mathematics Assessment Questionnaire is based on a cognitive-constructivist view of the development of mathematical thinking. The emphasis is on students' direct reflections on their cognitions or thinking, and their beliefs. The student is thus viewed as an active, reflective constructor of knowledge in the classroom. The

structure of the MAQ and the selection of statements for the MAQ are grounded in this view of individual learners in classrooms.

General Description of the Mathematics Assessment Questionnaire

The general structure and categories used in the Mathematics Assessment Questionnaire are shown in Figure 1-1, including the number of statements in each category. The questionnaire contains 161 statements and can be completed by most students in grades 7, 8 and 9 within one 40 minute class period.

The Mathematics Assessment Questionnaire has two sections:

Part I: students solve a nonroutine word problem and then respond to 20 statements about what they did while solving the problem. These statements prompt the students to reflect on and indicate their awareness of their thoughts before, during, and after they work on the problem. For example, students are asked to indicate if they tried to put the problem in their own words before they began to solve the problem. Students also indicate if they are aware of having used any one of four problem-solving strategies. Response categories for the Metacognitive statements are YES, MAYBE and NO.

The 20 statements in Part I are concerned with a student's "directed cognition"--the self-monitoring processes that are thought to be important in individual problem-solving. Such processes are sometimes called metacognition, or awareness of cognitive activities during problem-solving (Schoenfeld, 1985).

Part II: students respond to statements grouped within three activity settings:

1. During Class or teacher led instruction (49 statements);
2. Working With Other Students in a Group (53 statements); and
3. Doing Homework, an independent activity (39 statements).

Within each activity setting there are two sets of statements. The first set asks students about what they do while they work on mathematical word problems within that setting. These "Self-Regulatory" statements are grouped like the statements in Part I: What do I do before, during and after -- a teacher's lesson (During Class), working in a group (Working With Other Students), or working independently (Doing Homework). The statements focus on

Figure 1-1
Specifications for the Mathematics Assessment Questionnaire: Number of Statements for Psychological Constructs and Activity Settings

PSYCHOLOGICAL CONSTRUCT	ACTIVITY SETTING: During Class (Teacher-led)	Working With Other Students	Doing Homework
Metacognitive: Solving a math problem	20 METACOGNITIVE STATEMENTS LINKED TO ONE NON-ROUTINE PROBLEM		
.before you begin, planning, defining objective, setting goals	6	7	3
.as you work, monitoring progress, keeping track	8	8	3
.after you finish, evaluating, judging	5	8	3
.strategies employed			
Self-regulation			

PSYCHOLOGICAL CONSTRUCT	ACTIVITY SETTING: During Class (Teacher-led)	Working With Other Students	Doing Homework
Affective Beliefs			
.utility, value of math	3	3	3
.interest	3	3	3
.expectancies of success/confidence	3	3	3
.anxiety	3	3	3
Motivations			
.internal learning goals	3	3	3
.external performance goals	3	3	3
Attributions			
.internal stable controllable	3	3	3
.internal stable uncontrollable	3	3	3
.external stable uncontrollable	3	3	3
.unknown control	3	3	3

planning and goal setting (before), monitoring progress and keeping track (during), and judging, evaluating and reviewing (after). Students rate how true a statement is for them, on a scale from 1, VERY TRUE, to 5, NOT AT ALL TRUE.

The second set of statements in each activity setting asks students to reflect on their beliefs and feelings about mathematics word problems. These beliefs and feelings are related to "intentionality" or mathematical dispositions, as the NCTM Standards have grouped them. The constructs included in the Mathematics Assessment Questionnaire are:

1. Affective beliefs (4 constructs)--the utility or value of mathematical word problems, interest in word problems, confidence or expectation of success, and anxiety or concern about doing word problems;

2. Motivations (2 constructs)--internal learning goals and external performance goals; and

3. Attributions (4 constructs)--beliefs about the causes or reasons for one's success or failure.

Each of the ten constructs is assessed by three-item sets of statements within each of the three activity settings. As with the Self-Regulatory statements, students rate how true each statement is for them using a five point scale from 1 VERY TRUE to 5 NOT AT ALL TRUE.

Purpose of the Mathematics Assessment Questionnaire: Teacher Planning and Classroom Use

The Mathematics Assessment Questionnaire was developed with the intention of linking assessment with instructional planning and decision making. Current research (see Chapter II) suggests that the areas of beliefs assessed in the MAQ are positively associated with achievement in mathematics and persistence in problem-solving and course taking. Other research suggests that student and teacher classroom activities and beliefs vary as a function of the subject of the curriculum, for example, mathematics and social studies (Stodolsky, 1988).

Thus, the psychological constructs and classroom activity settings were selected to be relevant and useful for mathematics classrooms from both a research and a theoretical perspective. However, these are not sufficient grounds to suggest their usefulness in teacher planning of classroom instruction. The MAQ statements and methods of reporting students' responses were developed with the assistance of mathematics students, teachers, and teacher educators (discussed in Chapters III-IV). The purpose of this developmental process was to strengthen the link

between the meaning teachers derive from the MAQ statements and teachers' instructional planning and activities based upon student responses.

The MAQ is based on the view that a teacher's role is concerned with understanding and supporting or facilitating change in students' beliefs and thinking in a specific context, that of mathematical problem-solving. Embedding the assessment of student beliefs in the context of mathematics classroom activities was an attempt to directly link students' beliefs to teachers' thinking about instructional planning.

The Mathematics Assessment Questionnaire is presently in a paper and pencil format and can be summarized by hand or by a school-developed scanning program. As an assessment tool, the information from the MAQ can be used to suggest areas or questions for follow-up instructional activities with students. Possible uses for classroom planning are described in full in the Manual for Users (Tittle & Hecht, 1990). As with any assessment results, the information needs to be used together with data about students collected from other sources.

CHAPTER II

RESEARCH BACKGROUND

The Mathematics Assessment Questionnaire is designed to sample students' thoughts and feelings in relation to engaging in and learning the process of solving mathematical word problems. In Part I of the MAQ these thoughts and feelings or awarenesses are elicited following the working of a nonroutine mathematical word problem. In Part II the thoughts and feelings are elicited in the context of classroom activities. With the exception of Part I, the Metacognitive statements, each statement includes a thought or feeling about mathematical word problems in the context of a classroom activity--During Class (direct instruction), Working With Other Students (group work), or Doing Homework (individual work). In this chapter the definitions of the constructs and related research are discussed.

Research Related to Domain Definitions

Directed Cognition: Metacognition and Self-Regulation

Directed cognition is used here as a broad term which encompasses students' awareness of the activities and thinking they carry out when solving a single mathematical word problem (metacognition) and when participating in activities, such as class lessons given by the teacher, working with others in a group setting, or doing homework. In these broader activity settings, self-regulation is the term used to encompass student awareness of thinking and related activities, and performance control strategies.

Various writers categorize these processes differently, but we have kept the terms metacognition and self-regulation distinct, in acknowledgement of the focus in mathematics classrooms on individual problem-solving and on broader activities. For the purposes of the Mathematics Assessment Questionnaire, Metacognition refers to a student's awareness of her or his cognitive activities before, during and after working a specific mathematical problem. Self-Regulation refers to more general cognitive thoughts, behaviors and learning strategies in a specific classroom activity setting related to working mathematical word problems. Glaser and Bassok (1989) provide an overview of research in expert performance, developmental psychology and artificial intelligence problem-solving models that suggests the importance of these self-regulatory or control strategies in competent performance (pp. 641-647). They also suggest that, "Because knowledge of a rule or procedure is enhanced when one can oversee its applicability and monitor its use, self-regulatory skills are important outcomes of learning" (1989, p 641).

Metacognition

Metacognition refers to knowledge of the cognitive or thinking processes one uses while undertaking cognitive tasks such as problem-solving (Brown, 1978; Flavell, 1976; Garofalo & Lester, 1985). Although researchers differ in exactly how they define metacognition, this term generally refers to the thoughts or knowledge one has about one's thoughts. According to Flavell (1976), metacognition "...refers to one's knowledge concerning one's own cognitive processes and products or anything related to them..." (p. 232). Thus, metacognition is a general awareness of cognitive activities engaged in during a task. Discussions of metacognition have typically attempted to characterize the cognitive activities which a person might engage in while working a task or a problem. Terms such as monitoring, checking, and reviewing are frequently used in relation to metacognition.

Garofalo & Lester (1985) distinguish between two separate aspects of metacognition: "(a) knowledge and beliefs about the cognitive phenomena and (b) the regulation and control of cognitive actions" (p 163). Brown (1987) also distinguishes between metacognition which is related to knowledge about cognitions and metacognition which is related to regulation of cognition. Although the Mathematics Assessment Questionnaire focuses upon the second aspect of metacognition, the regulation of cognition, knowledge about the task and strategies for approaching the task cannot be clearly separated from regulation of the activity.

Attempts to characterize the regulatory activities which can occur during learning or metacognition have resulted in several classification schemes. Garofalo & Lester (1985) use a framework in which problem-solving decisions occur in a four-step model. First there is orientation or understanding of the problem, then organization or planning, followed by execution of the plan and finally, verification or looking back and checking the outcomes and decisions. Brown (1987) suggests a structure which focuses upon planning activities prior to undertaking the problem, monitoring activities during learning, and checking activities.

Using a group setting as a model to observe problem-solving activities, Schoenfeld (1987) has identified six metacognitive activities which can occur: reading, analyzing, exploring, planning, implementing and verifying. Schoenfeld's method involves asking a group of students to work a mathematical problem and then examining protocols of their activities. Schoenfeld (1985) describes competent problem-solvers as those who consistently monitor and

evaluate their solutions as they work. He uses episodes or stages to study the problem-solving protocols: read, analyze, explore, plan, implement, and verify (1985, p. 294). He notes that these activities need not occur sequentially, and in fact, successful problem-solvers will tend to spend time moving back and forth between each activity. Schoenfeld is one of the few researchers who has discussed metacognition in relation to the working of a specific mathematical problem. Instead, most discussions of metacognition have focused upon more general processes (e.g., Flavell, 1976).

Self-Regulation

Self-regulation has received attention in psychological theories that propose descriptions of the individual's activities involved in learning. In social learning theory, Bandura (1986) proposed a cognitive view of self-regulatory behavior that included subprocesses of self-observation, judgment, and self-reaction. Drawing on another view, Corno and Mandinach (1983) proposed that components of self-regulated learning are alertness, selectivity, connecting, planning, and monitoring, including self-checking. Meichenbaum (1976), in clinical studies of cognitively-oriented behavior modification, has also focused on strategies to help individuals control their own behaviors.

Zimmerman (1989) suggested that although definitions of self-regulation vary greatly, three features are common to most definitions concerned with academic performance. First, the student's choice and the use of specific processes, strategies, and responses is purposeful, with the goal to improve academic achievement. Second, there is a self-oriented feedback loop whereby students monitor the effectiveness of their strategies and their responses. Finally, Zimmerman noted that most definitions of self-regulated learning include a motivational dimension which describes how and why the student chooses a particular strategy, process, or response.

In the Mathematics Assessment Questionnaire statements in the Self-Regulation area are embedded in an activity setting. The statements are intended to elicit students' awarenesses of their monitoring, reviewing and evaluating thoughts in each setting.

The research of Good, Grouws and Ebmeier (1983) and Leinhardt and Putnam (1986) provided guidance for the During Class Self-Regulation statements. An example of a Self-Regulatory statement from the MAQ in the During Class setting -- at the beginning of a mathematics lesson about word problems is, "I know when the teacher is beginning a new math idea."

Mathematics Intentionality: Thoughts and Feelings About Learning Mathematics

Various thoughts and feelings have been found to be important in learning mathematics and in persisting in doing mathematical problem-solving (e.g., Chipman, Brush, & Wilson, 1985; Eccles, Adler, Futterman, Goff, Kaczala, Meece, and Midgley, 1985). The general category of intentionality, will, or "mathematical dispositions" is used in the MAQ to describe a student's affective beliefs, motivations, and attributions about learning mathematics. Paris (1988) has provided a persuasive argument that the student's understanding of the value of a skill--memory strategies in his example, is influential in the plans for and use of that skill. Others who have reviewed research about the interdependence of performance in mathematics and the learner's attitudes and feelings include McLeod (1988) and McLeod and Adams (1989).

The Mathematics Assessment Questionnaire includes ten psychological constructs or mathematical dispositions grouped into three major categories: affective beliefs, motivations, and attributions (see Figure 1-1, in Chapter I). The affective beliefs include the perceived value of a mathematically-related activity, interest in, confidence in, and anxiety or concern over doing a mathematical word problem. Motivations include the perceived reasons for approaching or learning mathematical problem-solving, whether these originate from the individual's own internal goals for learning or from external sources. Attributions include beliefs the student has about the causes for success or failure in learning or doing a mathematical word problem, as well as those instances in which the individual feels no sense of control about learning or performance outcomes.

Affective Beliefs

Value. Value refers here to the belief that learning about mathematical word problems is worthwhile, useful, or important. The statements about value are given in the context of one of the three activity settings. An example for the During Class setting is:

. Even when I listen to my teacher, I cannot understand how learning to solve word problems will help me in my everyday life.

Students who respond that this statement is VERY TRUE or TRUE provide one indicator that they see little value or link between classroom experiences in mathematics and their outside world.

Interests. Interests can be defined as topics or subjects that hold the learner's attention or arouse

feelings of curiosity, eagerness, liking or enjoyment. The negative aspects, that is disinterest, would be indicated by lack of curiosity, active disliking, or boredom. While not often assessed outside of career and occupational instruments, interest in mathematics and mathematical topics is a concern of teachers. An example of an Interest statement in the Working With Other Students setting is:

. I would find math interesting if I worked on a word problem with a group of students.

Interests are another source of motivation in learning, particularly when linked to occupational requirements. Students are often unaware of the extensive use of mathematics in many occupations.

Confidence. Confidence or expectations for success can be derined as a belief in one's own ability to do a task or learn a topic. An example is the belief that one can successfully solve a mathematical problem. Measures of expectancies are related to achievement and intention to take additional mathematics courses (Eccles, et al., 1985). An example of a Confidence statement in the Doing Homework setting is the following:

. I never expect to be able to do the types of word problems I get for homework.

Lack of confidence may be realistic, when mathematical skills are poor, and unrealistic when mathematical performance is high. Student responses to the confidence statements provide information that can be helpful in understanding student beliefs about their performance in solving mathematical word problems.

Anxiety. Anxiety is defined as a state of worry, uneasiness or fear about one's performance on a task or area of endeavor. A lack of anxiety is indicated by a state of relaxation, a lack of concern, or a feeling of comfortableness while working mathematical word problems. Anxiety is assessed here in the context of doing or learning about mathematical problem-solving in one of the three activity settings. An example of a statement in the During Class setting is:

. I am afraid when I have to ask my math teacher a question about a word problem during class.

Anxiety is not necessarily a problem. A moderate amount of anxiety can be facilitating -- encouraging studying for tests, for example. However, for students who mark the above statement VERY TRUE, learning may be hindered since the student may not be actively engaging in the classroom lesson. The response provides an indicator, or raises a

question, that can be followed up with a student.

Motivations

Motivation is concerned with the causes of goal oriented activity (Dweck, 1986). According to Dweck:

> Achievement motivation involves a particular class of goals--those involving competence--and these goals appear to fall into two classes: (a) learning goals, in which individuals seek to increase their competence, to understand or master something new, and (b) performance goals, in which individuals seek to gain favorable judgment of their competence or avoid negative judgments of their competence...(Dweck, 1986, p. 1040).

In general, Internal Learning Goals are intrinsic for the individual and emphasize learning because it is personally challenging and personally valued. External Performance Goals are extrinsically based and emphasize learning motivated by influences outside the individual, i.e., motivation based on grades or teacher approval.

In the Mathematics Assessment Questionnaire the indicators of motivation are statements that assess learning and performance goals. An example of each type is given below. Students indicate how true a statement is for them on the scale of 1, VERY TRUE, to 5, NOT AT ALL TRUE.

Internal Learning Goal: Working with Other Students Setting

. I would work hard on a word problem with other students because it would help me to understand how to do the problems.

External Learning Goal: Homework Setting

. The only reason I would do extra homework problems is if I could get extra credit.

Students who indicate that statements such as these are true for them are likely to differ in their reasons for learning. A long-term educational goal is to support the development of active mathematics learners and persistent problem-solvers who believe that learning is of intrinsic benefit to them.

Attributions

There are important sets of beliefs related to mathematics achievement and taking more mathematics courses that are labelled "attributions." These beliefs are also

related to motivation and the emotional or affective feelings students have toward mathematics. The particular attribution theory that guided the writing of the statements in the Mathematics Assessment Questionnaire is that of Weiner (1986).

Weiner suggests that three dimensions are important in understanding an individual student's logic of analysis or beliefs about what causes the student to succeed or fail in tasks such as mathematical problem-solving. The perceived causes of failure or success can be classified according to a three dimensional model which includes their locus of control, stability, and controllability. Locus of control concerns whether an individual attributes success or failure to personal or environmental causes. The stability dimension refers to whether the cause is seen as changeable or unchangeable. The third dimension, controllability, addresses whether or not the cause for success or failure is perceived to be within the individual's influence.

Although Weiner has a set of eight categories based on these three dimensions, a smaller number of categories have been selected for use in the MAQ. In the Mathematics Assessment Questionnaire four classifications of perceived causes of success or failure have been used. Examples of the statements within each classification are given for each of the categories. Again, students give their rating of how true the statement is for them on the scale 1, VERY TRUE, to 5, NOT AT ALL TRUE.

. Internal, Stable, Uncontrollable: During Class Setting

If I can follow my teacher's explanation for word problems, it is because I am smart.

The student who agrees that this statement is VERY TRUE, may be indicating a set of beliefs about how and why he or she achieves. The causal factor in success is perceived to be internal--the self. The cause is stable, something that does not change--smart = ability. And, the cause is uncontrollable, since ability is not something over which the student has control. You cannot change how smart you are. Contrast this set of beliefs with the next.

. Internal, Stable, Controllable: Working With Other Students setting

If I cannot solve a word problem with other students, it is because we did not try as hard as we could on the problem.

The student who agrees with this statement may be indicating a set of beliefs about causes of failure as follows: the causal factor in failure is internal--in the student; the

cause is stable--hard work; and yet the cause is controllable, "we didn't try as hard as we could." Students who attribute success or failure to something they can do or can not do, and believe it is controllable by them, have a set of beliefs that should facilitate learning. These beliefs can be contrasted with those in the third category:

. External, Stable, Uncontrollable: Homework setting

If I am unable to do homework word problems, it is because the math book is confusing.

The student who agrees with this statement may be indicating beliefs that the causal factor in failure is external to the student--the mathematics book; the cause is stable--a book; and the cause is uncontrollable, the student cannot change the mathematics textbook. Again, this is a set of causal beliefs about student failure that does not put the responsibility for the failure with the student. However, this student has some beliefs about why success or failure occurs. Contrast this statement with the next category, unknown control.

. Unknown Control: During Class Setting

I usually do not know what is going on when my teacher is explaining a word problem.

In this fourth category of attributions there is a perceived confusion and inability to make sense out of causality. Following Connell (1985), in Unknown Control students may be saying that they do not know why these learning outcomes occur. They indicate a lack of knowledge about the locus or source of causality. Another example that students might use is, "If I get a bad grade in school, I usually don't understand why I got it" (Connell, 1985, p. 1022).

The first three attribution or causal categories above were selected because they provide a contrast for students and teachers on two central dimensions: The internal-external locus of causality; and the perception of the cause as controllable or uncontrollable. The fourth category of Unknown Control provides a different construct--students who are confused or unclear about the relationships between their behaviors and performance outcomes for success or failure.

In summary, student responses to statements in these four categories may be useful in understanding how students attribute the causes of their successes and failures in mathematical problem-solving.

Overall, the statements in the Mathematics Assessment Questionnaire are based on specific psychological constructs

and are embedded in classroom activity settings for the purpose of providing examples of student responses that will assist in understanding the context in which performance of mathematical problem-solving occurs. Mathematical problem-solving occurs in the context of student thoughts, feelings and beliefs, and in the social context of classroom activity settings.

CHAPTER III

DEVELOPMENT AND PILOT STUDIES FOR THE MATHEMATICS ASSESSMENT QUESTIONNAIRE: VALIDITY RELATED EVIDENCE

The construction of the Mathematics Assessment Questionnaire is described in this Chapter. Throughout the development of the MAQ, there were two major concerns: the meaning of the statements to students and teachers, and the potential use of the statements for instructional planning. A major focus in development was on the form in which the information from student responses can be most usefully reported to teachers and the use of the MAQ by teachers for instructional planning. The usefulness of various groupings of statements and types of reporting of responses have been examined in collaboration with teachers. These studies are also described in this Chapter.

Feasibility Study 1986-1987

The development studies for the Mathematics Assessment Questionnaire began in 1986-87. During that year, the feasibility of the assessment tool was examined by reviewing the research and literature related to mathematics and attitudes, cognitive processes, motivations, and related constructs. This work was followed by the writing of sample statements in the context of classroom activities. Sixteen experienced teachers and mathematics educators from the New York City area attended a one-day meeting to discuss and evaluate the statements for their usefulness for instructional planning. Their responses were generally positive. The teachers indicated that the sample statements would provide information about students that is important in learning mathematics and information that is not currently available in standardized tests. Teacher ratings also indicated that student responses to the statements would provide information useful in planning instruction (Tittle, 1987).

Early Pilot Studies 1987-1988

The next stage in development took place during the 1987-88 academic year. During this period a series of small-scale studies were conducted which addressed a variety of issues related to the content, structure, and format of the MAQ.

Metacognitive Statements

Sample Metacognitive prompts or statements were written based upon a review of the literature as well as teacher and student interviews. These statements were written to include behaviors engaged in before, during and after

working a specific mathematical word problem (e.g., planning, monitoring, evaluation, and strategies). Studies were conducted to explore the wording of these sample Metacognitive statements and the types of word problems which could be used with the statements. These studies were designed to answer three questions about the Metacognitive statements.

Question 1. Were the types of Metacognitive statements proposed meaningful to students?

Question 2. Do students understand the proposed statements?

Study 1: As a first step in answering these two questions, four teachers and four mathematics teacher educators reviewed the sample Metacognitive statements for content, interpretability, and structure. They were encouraged to provide suggestions for revising the statements. Their comments were reviewed and some items were revised or eliminated.

Study 2: As a second step, 20 seventh and eighth-grade students were interviewed, either alone or in pairs, using the "think aloud" procedure. While working a word problem, the students were asked to talk out loud. They were then asked to respond to the Metacognitive statements. It was noted when they had difficulty understanding any of the statements. Students were also asked to explain what each Metacognitive statement meant to them, and were asked how they would say the same statement to classmates, using their own words.

Study 3: To further explore the words which students use to explain word problems, students in four mathematics classrooms responded to the following question, presented as part of an in-class exercise:

> "If you were asked to teach someone how to solve the following problem, what steps would you tell him/her to follow?"
>
> "1/4 + 1/3 = ?"

Student responses were reviewed. Attention was paid to the words students used to describe their working of the problem.

Question 3. Does it make a difference what type of word problem is worked before responding to the Metacognitive statements?

Two studies were conducted during 1987-88 to compare students' responses to the sample Metacognitive prompts following the working of different types of word problems.

The participating seventh and eighth-grade students in both studies were enrolled in urban, inner city schools.

Study 1: For the first study, alternate versions of a worksheet were randomly distributed within four junior high classes at three schools. All students worked the following mathematical problem:

> If I buy 4 candy bars at 15¢ each and pay for them with a dollar, how much change will I get?

On one version of the worksheet students were provided with multiple choice options in response to the word problem:

a) 19¢
b) 40¢
c) 60¢
d) 85¢

This version resembled the format on most standardized mathematics achievement tests. The second version was open ended, requiring the student to work the problem completely.

After students worked the word problem, with either the multiple choice or open ended form, they responded to the sample Metacognitive statements about what they did. All students were provided with four response categories:

DK - I don't know what I did
NO - No, I didn't do this
MAYBE - I may have done this
YES - Yes, I did do this

Table 3-1 presents the percentage of students in each group who responded to each category after working the problem. Students' responses to the Metacognitive statements differed somewhat depending upon the version of the worksheet (multiple choice or open ended).

However, regardless of the form which was administered, the "don't know" option was rarely selected (less than 9% of the time, and in most cases selected by no students). Furthermore, the classroom teachers noted that the students often found it difficult to distinguish between the "don't know" and "maybe" categories. As a result, it was decided to delete the "don't know" category from further studies.

When the teachers whose classes participated were asked about this task, they reported that the students seemed to understand the instructions and the wording of the items. Yet, both the students and teachers stated that the word problem worked was too easy and too routine for junior high school students. Some students remarked that they didn't

Table 3-1

Number and Percentage of Student Responses to the Metacognitive Statements After Working a Word Problem in One of Two Formats
A1 Multiple Choice Format (N=51); A2 Open Response Format (N=49)

Metacognitive Statements		Don't Know N	%	No N	%	Maybe N	%	Yes N	%	Missing N	%
1. I read the numbers and symbols before I read the words.	A1	0	(0)	35	(69)	0	(0)	16	(31)	0	(0)
	A2	0	(0)	36	(73)	0	(0)	11	(22)	2	(5)
2. I read the entire problem.	A1	0	(0)	3	(6)	1	(2)	47	(92)	0	(0)
	A2	0	(0)	1	(2)	0	(0)	48	(98)	0	(0)
3. I read the problem more than once.	A1	0	(0)	18	(35)	7	(14)	26	(51)	0	(0)
	A2	0	(0)	13	(27)	6	(12)	26	(53)	4	(8)
4. I asked myself, Do I understand what the question is asking me?	A1	1	(2)	19	(37)	9	(18)	22	(43)	0	(0)
	A2	0	(0)	12	(25)	8	(16)	28	(57)	1	(2)
5. Before starting the problem, I thought about a plan for doing it.	A1	2	(4)	16	(31)	5	(10)	26	(51)	2	(4)
	A2	2	(4)	19	(38)	5	(10)	22	(45)	1	(2)
6. I picked out the operation(s) I needed for this problem.	A1	0	(0)	3	(6)	1	(2)	46	(90)	1	(2)
	A2	1	(2)	3	(6)	6	(12)	38	(78)	1	(2)
7. I asked myself, Have I worked on a problem like this before.	A1	4	(8)	25	(49)	5	(10)	16	(32)	1	(2)
	A2	1	(2)	26	(53)	7	(14)	14	(29)	1	(2)
8. As I worked this problem, I checked my work step-by-step as I went along.	A1	1	(2)	17	(33)	3	(6)	30	(59)	0	(0)
	A2	0	(0)	12	(25)	5	(10)	30	(60)	2	(5)
9. I looked at the answer choices and picked the one that seemed right.	A1	0	(0)	14	(27)	5	(10)	31	(61)	1	(2)
	A2	[a]		-		-		-		-	
10. When I got my answer, I looked back at the problem to make sure it made sense.	A1	0	(0)	9	(17)	8	(16)	32	(63)	2	(4)
	A2	0	(0)	4	(8)	5	(10)	39	(80)	1	(2)

[a] Item not given on A2 form, open response format.

have to really think to answer this problem, but that the (Metacognitive) statements helped them, "think about what they should do." A teacher noted, "The problem was too easy for many of the students--therefore students who would normally re-read a problem did not." This may be one reason larger differences were not found among responses to the two formats.

The teachers also noted that some of the Metacognitive statements were not important, or at least not useful problem-solving approaches, given the problem which was worked. For example, one teacher felt that students' responses to the statement "I asked myself, Have I worked a problem like this one before?" did not provide meaningful information because the problem was very routine. As another teacher observed, "The questions would have been more useful if the original problem was one that required more thought." Therefore, it was decided to administer a somewhat more difficult nonroutine problem.

Study 2: The second study was designed to compare student responses on the sample Metacognitive statements using two different mathematics problems. One problem was a nonroutine coin problem:

> Eight pennies are arranged in a row on a table. Every other coin is replaced with a nickel. Then, every third coin is replaced with a dime. Finally, every fourth coin is replaced with a quarter. What is the total value of the coins on the table?

The other problem was a routine change problem:

> You spent $2.50 on cookies and three times as much on other food. How much change did you receive if you paid with a 20 dollar bill?

Students solved one of the two problems, then responded to the same set of Metacognitive statements. The response categories for this study were:

> NO - No, I didn't do this
> MAYBE - I may have done this
> YES - Yes, I did do this

The problems and statements were administered randomly within eight classrooms, so essentially equivalent groups of students responded to the statements following each problem. One hundred and five students worked the coin problem and 92 students worked the change problem. Students were in grades seven and eight, and attended one of three schools.

The data in Table 3-2 show that different questions elicit different awareness of cognitive activity on the part

Table 3-2

Percentage of Students Who Responded YES, MAYBE or NO to the Metacognitive Statements After Working One of Two Different Word Problems

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Problem A1: Eight pennies are arranged in a row on a table. Every other coin is replaced with a nickel. Then, every third coin is replaced with a dime. Finally, every fourth coin is replaced with quarter. What is the total value of the coins on the table?

Problem A2: You spent $2.50 on cookies and three times as much on other food. How much change did you receive if you paid with a 20 dollar bill.

Directions: First solve the problem. Then turn the page and answer the statements about what you thought and did.

BEFORE YOU BEGAN TO SOLVE THE PROBLEM - WHAT DID YOU DO?

		YES	MAYBE	NO	
1. I read the numbers and symbols first, then I read the words.	A1:	21%	24%	55%	(N=104)
	A2:	15%	18%	67%	(N= 91)
2. I read the entire problem.	A1:	94%	2%	4%	(N=104)
	A2:	95%	3%	2%	(N= 92)
3. I thought to myself, Do I understand what the question is asking me?	A1:	68%	22%	10%	(N=105)
	A2:	61%	17%	22%	(N= 92)
4. I tried to put the problem into my own words.	A1:	45%	25%	30%	(N=105)
	A2:	26%	25%	49%	(N= 92)
5. I read the problem more than once.	A1:	86%	8%	6%	(N=104)
	A2:	76%	9%	15%	(N= 92)
6. I asked myself, Do I know how to do this problem?	A1:	55%	27%	18%	(N=101)
	A2:	44%	18%	38%	(N= 90)
7. I tried to remember if I had worked a problem like this before	A1:	36%	15%	49%	(N=105)
	A2:	30%	20%	50%	(N= 92)
8. I thought about what information I needed to solve this problem.	A1:	76%	13%	11%	(N=105)
	A2:	70%	20%	10%	(N= 92)
9. I asked myself, Do I have enough information to solve this problem	A1:	39%	32%	29%	(N=104)
	A2:	41%	18%	41%	(N= 91)
10. I asked myself, Is there information in this problem that I don't need?	A1:	22%	23%	55%	(N=104)
	A2:	17%	21%	62%	(N= 92)

Table 3-2 (continued)

		YES	MAYBE	NO	
11. I picked out the operations I needed to do this problem.	A1:	65%	19%	16%	(N=104)
	A2:	71%	15%	14%	(N= 92)
12. I felt confused and could not decide what to do.	A1:	28%	33%	39%	(N=105)
	A2:	16%	16%	68%	(N= 92)
13. I drew a picture to help me understand the problem.	A1:	48%	9%	43%	(N=105)
	A2:	6%	11%	83%	(N= 92)

AS YOU WORKED THE PROBLEM - WHAT DID YOU DO?

		YES	MAYBE	NO	
14. I wrote out all the steps as I worked the problem.	A1:	52%	18%	30%	(N=100)
	A2:	52%	14%	34%	(N= 89)
15. I kept looking back at the problem after I did a step.	A1:	77%	8%	15%	(N= 99)
	A2:	53%	14%	31%	(N= 89)
16. I had to stop and rethink a step I had already done.	A1:	42%	27%	31%	(N=100)
	A2:	42%	14%	44%	(N= 89)
17. I checked my work step-by-step as I worked the problem.	A1:	67%	18%	15%	(N=100)
	A2:	61%	14%	25%	(N= 88)
18. I did something wrong and had to re-do my step(s).	A1:	40%	20%	40%	(N=100)
	A2:	23%	17%	60%	(N= 89)
19. I looked back to see if I did the correct calculation.	A1:	77%	14%	9%	(N= 97)
	A2:	74%	10%	16%	(N= 89)
20. I checked to see if my calculations were correct.	A1:	74%	14%	12%	(N= 98)
	A2:	81%	7%	12%	(N= 88)
21. After I did the problem I went back and checked it all again.	A1:	48%	27%	25%	(N= 98)
	A2:	50%	21%	29%	(N= 87)
22. I stopped before I got an answer to this problem.	A1:	24%	27%	49%	(N= 97)
	A2:	20%	20%	60%	(N= 89)
23. When I got my answer, I looked back at the problem to see if my answer made sense.	A1:	74%	15%	11%	(N= 99)
	A2:	64%	15%	21%	(N= 89)

of students. For example, statement 4 shows that students who worked the coin problem reported that they tried to put the problem in their own words more frequently than students who worked the change problem. The coin problem is a nonroutine problem with more than one answer, whereas the other problem is routine and has only one answer.

The results indicate the importance of providing students with opportunities to apply their mathematical skills to problems that are challenging. Furthermore, the problems should encourage the view that problems can have more than one way to work them and may have more than one solution. Based on this study, the nonroutine coin problem was selected for the Mathematics Assessment Questionnaire.

Self-Regulatory, Affective Belief, Motivation and Attribution Statements

Existing measures of mathematics anxiety, confidence, value and interest typically ask students to respond to the general term, "mathematics" or "math." Since the Mathematics Assessment Questionnaire is intended to be useful for classroom instructional purposes, there was a concern about the specificity of the statements that might be needed. Studies were therefore conducted to examine the effect of using different mathematical content and different levels of specificity of the content (e.g., mathematics or mathematical word problems).

Question 1. Do students respond differently when the mathematical content and level of specificity are varied?

Two worksheets were randomly distributed within three seventh and eighth-grade junior high school classrooms in two schools. Students were presented a list of various mathematical topics. Approximately half the students in each class were presented the mathematics topics in words, such as read a graph, division, use a calculator, fractions, figure change in a store, mathematics problems, word problems, decimals, and mathematics puzzles. The other half of the students were asked the same two questions, but presented actual examples of mathematical problems, for example, 2.003 + 1.4 + 4.09. The students were then asked: 1) how much they would like to do, and 2) how easy or hard it would be to do, the various mathematics topics.

Examination of the responses to statements on each form suggested that both students' reported liking and students' perceptions of difficulty differ depending upon the mathematical content, as might be expected. That is, students might report liking one type of problem, but disliking another. Thus, the distribution of responses differed for the different topics or problems.

Although the same students did not complete both forms, the distributions were compared across the two forms for somewhat comparable subject matter topics. This suggested that the level of specificity had an impact upon students responses. For example, when asked

How much would you like to do math "word problems?"

the number and percentage of students responding were:

	N	%
like very much	9	18
sort of like	28	56
sort of dislike	10	20
dislike very much	3	6

However, when asked the same question in reference to the following word problem:

> One pencil costs 10c and one pen costs 25c. If Barbara wants to buy five pencils and four pens, how much money does she need?

the number and percentage of students responding were:

	N	%
like very much	31	62
sort of like	15	30
sort of dislike	4	8
dislike very much	0	0

The first example included a less specific mathematical topic (math word problems) than the second example (a specific word problem). These results suggest that students' reports of liking/disliking of mathematical word problems vary as a function of the level of specificity and mathematical content or topic in the statement to which they respond.

Question 2. Are student responses affected by using the term "mathematics" vs. "mathematics word problems" vs. a verbal description of a word problem vs. a particular word problem?

To answer this question, statements with differing levels of content specificity were randomly administered to students within each of eight mathematics classes (grades seven and eight) from three public schools in New York City. The statements were presented on two forms which differed only in the wording of the most specific item. The most specific item on Form 1 provided a verbal description of a word problem, while the most specific item on Form 2 included an example of a word problem. On each form, the same basic items were presented with three different levels of specificity. For example, responses were obtained to

statements with "math," (general level of specificity), "word problems," (a more specific level), and either the phrase, "word problems with adding or subtracting decimals" or an actual word problem using decimals (very specific).

Students indicated how true each statement was for them on a scale from 1, VERY TRUE, to 5, NOT AT ALL TRUE. Table 3-3 presents the results for statements about anxiety and confidence, written at different levels of specificity. The percentages in the table represent the students responding VERY TRUE plus TRUE in Example 1 and VERY TRUE in Example 2.

As shown in Table 3-3, student responses varied according to the level of specificity at which the statements about mathematics were written. In each example differences among the levels of specificity were found. Example 2 presents the shift for the Confidence statements. Students expressed less confidence when asked about learning to do mathematics homework problems described in words, than when they were actually given an example of a word problem. The use of very specific topics and problems was not feasible given the range of grades and types of classes for which the MAQ is intended. Therefore, it was decided to use the level of specificity "mathematics word problems" in the MAQ. It is more specific than "mathematics" and more directly links to the questionnaire's emphasis on applications to mathematical word problems.

Usefulness of Sample Statements for Teachers

Question 1: Do Teachers Find the Sample Statements Useful?

As part of the early pilot studies, teachers were asked to rate the usefulness of sample Metacognitive, Self-Regulatory and affective belief, motivation and attribution statements. Sample statements were administered in four classes. The teachers in these classes were asked to review their students' responses to the statements and provide feedback concerning the usefulness the responses would have for teachers. Their responses were reviewed and used to revise the statements.

Spring 1988 Pilot Study

A pilot study was conducted during April and May of 1988. During the first phase of this study, the Mathematics Assessment Questionnaire - Pilot Questionnaire was developed, based upon the results of the early pilot studies. During the second phase of the pilot study, the statements were administered to students in grades seven, eight and nine attending either junior or senior high schools in New York City.

TABLE 3-3

Percentage of Students Responding TRUE or VERY TRUE to Statements Varied in Level of Specificity for Two Psychological Constructs: Anxiety and Confidence.

Example 1: ANXIETY

Level of Specificity	Statement
General:	I worry when I have to do math.
Specific:	I worry when I have to do math word problems for homework.
Very Specific: (words)	I worry when I have to do math word problems where I must multiply fractions for homework.
Very Specific: (example)	I worry when I have to do math word problems like this for homework: The traffic light changes every 20 seconds. How many times will it change in 1-1/2 hours?

	Percentage of Students Responding Very True or True	
Level of Specificity of Statement	Form 1 (N=105)	Form 2 (N=104)
General:	31%	31%
Specific:	20%	17%
Very Specific: (words)	35%	-
Very Specific: (example)	-	40%

Percentages indicate students who responded VERY TRUE or TRUE.

TABLE 3-3 (Continued)

Example 2: CONFIDENCE

Level of Specificity	Statement
General:	I know I can learn to do most math problems.
Specific:	I know I can learn to do most math homework problems which involve word problems.
Very Specific: (words)	I know I can learn to do most math homework problems which involve word problems with several addition steps.
Very Specific: (example)	I know I can learn to do most math homework problems like this: A softball team won 15 games, It lost 3 more than it won. How many games has the team played?

Level of Specificity of Statement	Percentage of Students Responding Very True	
	Form 1 (N=105)	Form 2 (N=104)
General:	71%	74%
Specific:	53%	54%
Very Specific: (words)	47%	-
Very Specific: (example)	-	72%

Percentages indicate students who responded VERY TRUE.

Phase 1
Development of the Mathematics Assessment Questionnaire - Pilot Questionnaire

The Domain Specifications for the Mathematics Assessment Questionnaire - Pilot Questionnaire are presented in Table 3-4. With the exception of the Metacognitive statements, items were written based upon a facet design which linked three dimensions:

1) Mathematical topic and task variables
2) Situation/learning setting
3) Psychological constructs, including self-regulation

The mathematical content, Dimension 1, was in effect held constant by using the term, "mathematical word problems." In the Pilot Questionnaire, eight settings for learning were used. These include individual work settings (Homework and Deskwork), large group or classroom work settings (During Class), small group or co-operative group work settings (Working With Other Students), and evaluative settings (Taking a Test, Getting a Grade, Taking the City-Wide Test, Evaluation of Self). The psychological constructs are grouped into five categories: Metacognition, Self-Regulation, affective beliefs, attributions, and motivations.

The 96 possible pairings of psychological constructs by settings (P=12 x S=8) are depicted in Figure 3-1. Since the Metacognitive statements are not linked to a specific setting, this psychological construct is not included. Of these pairings, 94 were used in the Pilot Questionnaire. The two categories excluded were:

Internal Learning Goals - Teacher Grading; and
External Performance Goals - Evaluation of Self

These two categories were excluded since it was felt the setting and psychological construct could not logically be linked. In each instance, one was externally based while the other was internally based.

Metacognitive Statements

As discussed in a previous section, several early pilot studies were conducted to help develop the Metacognitive prompts or statements. Before inclusion in the Mathematics Assessment Questionnaire - Pilot Questionnaire, the statements were reviewed by mathematics teachers for their meaning and usefulness for instructional planning. The

TABLE 3-4

Mathematics Assessment Questionnaire - Pilot Questionnaire
Domain Specifications: Item Pool Facets

Dimension 1: Mathematical Topics and Task Variables

- Mathematical Content
  - Whole number, Patterns
  - Rational Numbers: Decimals, Fractions, Percents
  - Ratios, Proportions
  - Geometry, Basic Measurement Concepts
  - Probability, Statistics
  - Computer Awareness
  - Mathematical Operations (addition, subtraction, division, multiplication, graphs)
- Mathematical Process
  - Word Problems (routine one-step, routine multi-step, nonroutine one-step, nonroutine multi-step)
  - Concepts
  - Computation
- Problem Format
  - Response Format (open ended)
  - Structure of the Problem (how presented)
  - Length of Problem
- Problem Difficulty
  - Easy
  - Average
  - Hard

Dimension 2: Situation/learning settings

- Individual work
  - Deskwork (seat-work)
  - Homework
- Large group (teacher directed) instruction
- Small group (teacher absent) learning
- Evaluation (what "product," who evaluates)
  - By standardized tests
  - By teacher made tests
  - By self
  - By teacher grading

TABLE 3-4 (continued)

Dimension 3: Psychological Constructs

Metacognition: Self Directed Attention and Cognitive Effort while working on a single problem

- Planning, goal setting, defining objectives: Before you begin
- Monitoring progress, keeping track: As you work
- Judging, evaluating, reviewing: After you are done

Self-regulation: Self Directed Attention and Cognitive Effort during activity settings

- Planning, goal setting, defining objectives: Before you begin
- Monitoring progress, keeping track: As you work
- Judging, evaluating, reviewing: After you are done

Affective Beliefs

- Mathematics as a subject, how to do math
- Utility/value of math
- Expectancy of success, confidence
- Self as an active learner, how learning is structured
- Interests
- Anxiety concerning mathematics

Attributions (role of ability and effort)

- Internal, stable, controllable
- Internal, stable, uncontrollable
- External, stable, uncontrollable
- Unknown control

Motivation

- Internal learning goals (intrinsic)
- External performance goals (extrinsic)

FIGURE 3-1

Specification for the Mathematics Assessment Questionnaire:
Pilot Questionnaire
ACTIVITY SETTING

PSYCHOLOGICAL CONSTRUCT	Seatwork	Homework	Direct instruct.	Work in Group	Evaluation class	Evaluation city-wide	Evaluation teacher	Evaluation self
Metacognitive: Solving a math problem .before you begin, planning, defining objective, setting goals .as you work, monitoring progress, keeping track .after you finish, evaluating, judging .strategies employed Self-regulation .planning before begin, defining objective, setting goals .as you work, monitoring progress, keeping track .after evaluation, judging what done	21 METACOGNITIVE ITEMS NOT LINKED TO A SETTING - LINKED TO A SPECIFIC NON-ROUTINE PROBLEM							
Affective Beliefs .math as a subject								
.utility, value of math								
.expectancies of success/confidence								
.anxiety								
.interest								
.self as active learner/ how like to structure learning								
Motivation .internal learning goals								
.external performance goals								
Attributions .internal stable controllable								
.internal stable uncontrollable								
.external stable uncontrollable								
.unknown control								

result was a set of 21 statements grouped into four categories: general problem-solving strategies; and specific strategies used before, during, and after solving the word problem.

Students responded to the Metacognitive statements about what they did after they worked the following nonroutine coin problem:

> Eight pennies were arranged in a row on a table. Every other coin is replaced with a nickel. Then, every third coin is replaced with a dime. Finally, every fourth coin is replaced with a quarter. What is the total value of the coins on the table?

As mentioned above, this problem was selected because the method of solution, although not obvious, is not beyond the grasp of students in grades seven through nine and is not dependent upon knowledge of a specific mathematical topic. During the early pilot studies, it was found that junior high school students of average mathematics ability were able to solve this problem.

Self-Regulatory, Affective Belief, Motivation, and Attribution Statements

Examples of behaviors and thoughts which reflect self-regulatory learning and the various affective beliefs, motivations and attributions within each activity setting were developed based upon a review of the relevant literature. This list of behaviors was then used to guide the writing of the statements. All statements were written so that students could respond to them by indicating how true the behavior or thought was for them within the given activity setting. The statements were reviewed by teachers and mathematics educators for their relevance to classroom instruction.

Based upon the results of the early pilot studies it was decided to set the level of specificity of the mathematics content as "mathematical word problems." Each Self-Regulatory and affective belief, motivation, and attribution statement was written in the context of a specific setting, and the statements necessarily differed somewhat across settings. The inclusion of statements with somewhat different contents for each setting added variability. Yet, research suggests that the appropriateness and use of various types of self-regulatory behaviors are closely associated with the setting in which the behavior occurs. For example, self-regulatory behaviors within a group problem-solving setting can include both group related factors as well as individual problem-solving factors. In contrast, within a teacher led or direct class instructional setting, students interact primarily with a

teacher. Similarly, how affective beliefs, motivations and attributions are expressed may differ among settings.

As shown in Figure 3-1, the Self-Regulatory statements were written to encompass three general types of self-regulated behaviors: planning, monitoring, and evaluating or checking behaviors. This framework was used across all settings. Within the questionnaire itself, the statements were grouped into these three categories to provide a general orientation or structure for the students: before beginning the activity, during the activity, and at the end of the activity.

In order to help assess whether individual statements reflected the affective, motivational and attributional psychological constructs for which they were written, 344 items were given to three doctoral students in Educational Psychology who were familiar with the study. They sorted the items according to the psychological constructs. Although agreement varied slightly according to psychological construct, the three students agreed with the original classification of 166 items (63%). At least two students sorted 96% of the items into the categories for which they were written. Guided by these results, items were rewritten, reclassified or discarded.

A minimum of three self-regulatory, affective belief, motivation and attribution statements per cell (see Figure 3-1) were included in the Mathematics Assessment Questionnaire - Pilot Questionnaire. By including a minimum of three items per cell, when responses were inconsistent across the statements it was possible to assess which two of the three statements were responded to similarly, when responses were inconsistent across statements.

Attempts were made to balance positive and negative statements within cells (i.e., one item positive and two negative or one negative and two positive). Across the broader activity categories, even or balanced representation of positively and negatively worded items was attempted. For example, for the individual work category (Deskwork and Homework), attempts were made to include a total of 3 positive items and 3 negative items.

Design of the Three Forms of the Pilot Questionnaire

Since there were 450 statements, too many for one student at the junior high school level to complete during a 40 minute class, the statements were printed in three booklets for administration. Table 3-5 presents an overview of the constructs represented in each booklet.

* Form I has three sections. In Part I students solve a word problem and then respond to the 21 Metacognitive

TABLE 3-5

Summary of Constructs Included on the Three Forms of the Mathematics Assessment Questionnaire - Pilot Questionnaire

Form I: (182 items)	Metacognitive statements (with accompanying word problem) Self-Regulatory statements Selected affective belief, motivation and attribution statements (See TABLE 3-5A)
Form II: (187 items)	Affective Belief statements (represented in all eight settings) Anxiety Confidence Interest Mathematics as a Subject Value Self as an Active Learner General statements (not represented in a setting)
Form III: (170 items)	Attribution and Motivation statements (represented in all eight settings) Internal Stable Uncontrollable Internal Stable Controllable External Stable Controllable Unknown Control Internal Learning Goals External Performance Goals Self as an Active Learner

statements about what they did while solving the problem. Part II includes the Self-Regulatory statements, specific thoughts and activities while learning or working word problems in the eight classroom activity settings. Part III includes some items that are also on Form II and/or Form III (see Table 3-5A).

* Form II includes statements assessing students' anxiety about, valuing of, interest in, and confidence in doing mathematics word problems in the various settings, as well as their beliefs about mathematics as a subject, and self as an active learner of mathematical word problems in the different settings.

* Form III includes items that are intended to elicit students' motivations and attributions -- the reasons to which they attribute their success or failure.

The response categories are YES, MAYBE and NO for the first 21 statements on Form I. All the other items, for all three forms, have the response categories VERY TRUE, TRUE, SORT OF TRUE, NOT VERY TRUE, and NOT AT ALL TRUE, a scale from one to five.

Each form had a "mini-pool" of 22 common items. All forms included statements for the construct "Self as an Active Learner." In addition there were items which were shared by two forms. Table 3-6 presents the number of items unique to a given form, shared by two forms, and common to all forms. It also indicates the approximate percentage of students in the pilot study sample answering each statement, of a total of 1557 students in the sample.[1]

Phase 2
Administration, Sample Description, and Analyses of the Mathematics Assessment Questionnaire - Pilot Questionnaire

Administration

During April and May of 1988, seventh, eighth and ninth-grade students in New York City were administered the three forms of the Mathematics Assessment Questionnaire - Pilot Questionnaire. The booklets were randomly administered within classrooms in nine New York City public schools and one parochial school. A total of 10 schools were included, with 21 grade seven classes, 22 grade eight classes and 20 grade nine classes.

The numbers of classrooms in which students were recruited for the pilot study are shown in Table 3-7 by grade and type of school. Different types of schools were included since seventh, eighth and ninth-grade students in New York City may attend a variety of schools: Public Schools - PS (grades 1-7), Intermediate Schools - IS (grades 6-8), Junior High Schools - JHS (grades 7-9) or High Schools - HS (grades 9-12). Although the majority of seventh and eighth-grade students attended an IS or JHS located either in Brooklyn or the Bronx, one PS school in Brooklyn was also included. The ninth-grade students attended either JHS or HS schools, in either the Bronx or Staten Island. All students were English-speaking and in the middle range of average achievement in math; neither low remedial nor high gifted classes were included.

[1] Copies of the three forms of the Pilot Questionnaire are available from the authors.

TABLE 3-5a

Psychological Constructs by Activity Setting Included on the Mathematics Assessment Questionnaire - Pilot Questionnaire, Form I - Part III

Activity Setting	Psychological Constructs[1]		
Deskwork		ISC	SAL
Homework	Interest	ILG	SAL
During Class	MAS	ISU	SAL
Working With Other Students	Confidence	ESU	SAL
Taking a Test (Classroom)	Anxiety	UK	SAL
Getting a Grade	Value	EPG	SAL

[1] Psychological Construct

VALUE	Value (3 items)
INTEREST	Interest (3 items)
CONFIDENCE	Confidence (3 items)
ANXIETY	Anxiety (3 items)
ILG	Internal Learning Goals (4 items)
EPG	External Performance Goals (3 items)
ISC	Internal Stable Controllable (3 items)
ISU	Internal Stable Uncontrollable (3 items)
ESU	External Stable Controllable (3 items)
UK	Unknown Control (4 items)
SAL	Self as an Active Learner (22 items
MAS	Mathematics as a Subject (5 items)

TABLE 3-6

Number of Common, Shared, and Unique Items
on Each of the Three Forms of the
Mathematics Assessment Questionnaire - Pilot Questionnaire
and Percentage of Sample Responding to Each Form

	Form I	Form II	Form III	Percentage of sample taking items
common	22	22	22	100%
shared	18	18		67%
shared	19		19	67%
shared		8	8	67%
unique	123			33%
unique		139		33%
unique			121	33%
Total Items	182	187	170	

Table 3-7

Number of Classes and Schools Grouped by School Type and Location for the Pilot Study

School Type and Grade	School Location: Brooklyn	Bronx	Staten Island
Public Schools	1[a]		
grade seven	4[b]		
eight	4		
Intermediate Schools	1	2	
grade seven	4	5	
eight	4	6	
Junior High Schools		3	
grade seven		8	
eight		8	
nine		8	
High Schools	1		2
grade nine	5		7
Total Number of classes	21	35	7

Total:

seventh-grade n=21 classes
eighth-grade n=22 classes
ninth-grade n=20 classes

N=63 classes

PS = 1 school
IS = 3 schools
JHS = 3 schools
HS = 3 schools

N = 10 schools

[a] Number of schools.
[b] Number of classes.

Forms were spiraled for distribution within class (Form I, Form II, Form III, Form I, Form II, Form III...). Instructions were read by the classroom teacher during the administration of the Pilot Questionnaire, with a member of the project staff present. It was informally observed during the administration that students had the most difficulty understanding the statements on Form III (attributions and motivations). This form included the most lengthy statements, which were also generally the most complex statements. Form I was most easily completed by the students.

Sample

A sample of 1557 students responded to the three forms of the Mathematics Assessment Questionnaire - Pilot Questionnaire. Approximately equal numbers of students from each grade participated. The responses were scanned visually to identify pattern markings. For example, one student made "zig-zag" circles across the pages, others marked a single response across all statements. These booklets were excluded from the analyses. A total of 189 booklets were eliminated because students left over 50% of the items blank or because students randomly checked responses. Of these 189 forms, 52 were obtained from seventh-graders, 57 from eighth-graders, and 80 from ninth-graders. The sample for the analyses consisted of 460 students who responded to Form I, 476 students who responded to Form II and 432 students who responded to Form III. The exclusion of booklets accounts for the variable sample sizes for the three forms.

The sex, grade level and age distributions for each form of the Pilot Questionnaire are given in Table 3-8. There were more females than males completing the questionnaires and more seventh-grade students than eighth or ninth-grade students. Students' ethnicity was visually classified: approximately 1/3 were Black, 1/3 Hispanic and 1/3 White.

Data Analyses

The general objectives of the data analyses were to reduce the size of the item pool and to examine the structure of the domain in relation to the item facets. A specific goal was to have a single questionnaire which could be administered during one 40 minute class period, making it more likely that the questionnaire could be used within the current school schedule. A further goal was to maintain the representativeness of the structure of the domain specifications originally identified (see Figure 1-1 and Figure 3-1). Since different students answered each form, responses to Forms I, II, and III were examined separately.

TABLE 3-8

Sex, Grade Level and Age of Students Who Responded to the Mathematics Assessment Questionnaire - Pilot Questionnaire

	Form I (N=460)		Form II (N=476)		Form III (N=432)	
	N	%	N	%	N	%
Sex						
Males	177	(38.5)	196	(41.2)	168	(38.9)
Females	255	(55.4)	268	(56.3)	248	(57.4)
Missing	28	(6.1)	12	(2.5)	16	(3.7)
Grade						
Seven	164	(35.7)	172	(36.1)	162	(37.5)
Eight	143	(31.1)	144	(30.3)	129	(29.9)
Nine	123	(26.7)	123	(25.8)	116	(26.8)
Missing	30	(6.5)	37	(7.8)	25	(5.8)
Age						
11	5	(1.1)	4	(.8)	4	(.9)
12	81	(17.6)	82	(17.2)	79	(18.3)
13	129	(28.1)	147	(31.0)	119	(27.5)
14	127	(27.7)	119	(25.0)	127	(29.4)
15	80	(17.4)	80	(16.9)	66	(15.3)
16	23	(5.0)	26	(5.5)	16	(3.7)
17	7	(1.5)	4	(.8)	8	(1.9)
18	2	(.4)	3	(.6)	2	(.5)
Missing	6	(1.3)	11	(2.3)	11	(2.5)

Based upon the following analyses, statements were retained, revised or deleted.

Item distributions and inter-correlations

The first question addressed was whether the three grade levels -- seven, eight, and nine, could be pooled for purposes of analysis. The individual item distributions, means, and correlations among individual items based upon responses from each of the three grade levels were examined for each form. These comparisons suggested there were no systematic, meaningful differences between any of the forms. Therefore the responses of the three grades were pooled, providing maximum sample sizes on each form.

Factor analyses and internal consistency analyses

The second question addressed was the dimensionality of the item pool in relation to the original domain specifications. The dimensionality of the item pool was examined using factor analyses and the internal consistency of responses was examined using coefficient alpha reliabilities.

Metacognitive Statements: The 21 Metacognitive statements were subjected to a principal axis factor analysis. The two, three and the four factor solutions were examined. The two factor solution accounted for 20.3% of the variance, the three factor solution accounted for 24.6% of the variance and the four factor solution accounted for 27.2% of the variance. Although the four factor solution did not exactly replicate the grouping used in the Pilot Questionnaire, it supported the general structure which was proposed.

Coefficient alpha reliabilities were computed based upon the groupings used in the Mathematics Assessment Questionnaire - Pilot Questionnaire. The coefficients ranged from .30 (strategies) to .58 (after working the problem). They are presented in Table 3-9. Based upon the results of the factor analyses and examination of the reliability coefficients, one Metacognitive item was dropped and one item was reclassified.

Self-Regulatory Statements: Separate factor analyses were performed using the Self-Regulatory statements within each activity setting. The two, three and four factor solutions were examined. The three factor solutions accounted for between 33.7% of the variance (During Class setting) and 57.7% of the variance (Getting a Grade setting). Within the Working With Other Students setting, the three factor solution accounted for 37.4% of the variance. The three factor solution of the Homework items accounted for 43.1% of the variance.

TABLE 3-9

Coefficient Alpha Reliabilities for the Metacognitive Items of the Mathematics Assessment Questionnaire - Pilot Questionnaire

Activity Setting	Item Number	Coefficient Alpha Reliabilities
Before	1- 6	.458
During	7-11	.489
After	12-16	.583
Strategy	17-21	.380

Table 3-10 presents the coefficient alpha reliabilities for the Self-Regulatory items based upon the groupings used in the Pilot Questionnaire. These values ranged from .51 (Doing Homework: While Working) to .82 (Evaluation of Self).

Based upon an examination of the factor analyses and the reliability estimates, items were revised, rewritten or dropped for the three settings selected for the current version of the Mathematics Assessment Questionnaire. Within the During Class setting, one item was dropped. Within the Working With Other Students setting, two items were revised. Two items were dropped, one item was reclassified and two items were rewritten in the Homework setting.

Affective Belief, Motivation and Attribution Statements: Two sets of factor analyses were performed using the affective belief, motivation, and attribution items:

a) within psychological construct across settings
b) within setting across psychological constructs.

The factor analyses were done for each construct. Similarly, all items written to assess constructs within the activity setting of "During Class" on a given form were entered into another factor analysis. Thus, different settings or a number of different constructs were included in each analysis. These analyses failed to reveal clear, interpretable factors. The lack of interpretability appeared due in large measure to the heterogeneity of responses since several setting or constructs with between three and five items each were included in each analysis.

TABLE 3-10

Coefficient Alpha Reliabilities for the Self-Regulatory Items of the Mathematics Assessment Questionnaire - Pilot Questionnaire

During Class		
Before	1- 6	.640
During	7-14	.625
After	15-20	.804
Working With Other Students		
Before	21-27	.728
During	28-35	.797
After	36-43	.806
Working at Your Desk		
Before	44-46	.605
During	47-49	.536
After	50-52	.649
Doing Homework		
Before	53-55	.626
During	56-58	.506
After	59-61	.609
Taking a Class Test		
Studying	62-64	.811
Before	65-67	.730
During	68-70	.572
After	71-73	.579
Taking the City-Wide Test		
Before	74-76	.617
During	77-79	.659
After	80-83	.725
Getting a Grade		
Before	84-86	.776
During	87-89	.755
After	90-92	.804
Evaluating Self		
	93-102	.825

For example, all items which were written to assess Interest were factor analyzed (within construct, across settings).

A second approach was taken to the question of dimensionality. The internal consistency of responses within individual cells of the domain specifications was examined for the three item clusters. Coefficient alpha reliabilities were computed for items within each of the cells, after adjusting for the direction of the wording.

The coefficients are presented in Table 3-11. As Table 3-11 indicates, the reliability coefficients for two constructs-- Self as an Active Learner and Mathematics as a Subject, were low and inconsistent across most settings. An examination of the statements suggested that these constructs represented a heterogeneous group of statements. For the remaining constructs, the coefficients ranged from .00 to .79, with a mean of .52.

For the settings and constructs retained for Phase 3, several items were rewritten to increase the internal consistency estimates. Examination of the coefficient alpha reliabilities, correlations among the items within a cluster, and the change in the reliability estimate when statements were included or excluded within a cluster, provided guidance for adding, revising, or deleting statements.

Phase 3
Revision of Item Pool and Development of the Mathematics Assessment Questionnaire

The revision of the item pool and the development of the present version of the MAQ was guided by two considerations. The first was programmatic, the need for a questionnaire that would fit within the typical school schedule for mathematics classes, a 40-minute class period. The second was theoretical, to retain a model of the domain structure which included both settings and psychological constructs. Thus, for the purposes of the Fall 1988 administration it was necessary to limit the questionnaire to the number of statements which students could complete within a single 40 minute class period. A single questionnaire that included the major elements of the entire item set would permit assessment of the facet approach as well as the general structure of the domain specifications.

It was decided to retain 10 psychological constructs: Value, Interest, Confidence, Anxiety, Internal Learning Goals, External Performance Goals, Internal Stable Controllable, Internal Stable Uncontrollable, External Stable Uncontrollable and Unknown Control. It was also decided to focus upon three activity settings: During Class,

Table 3-11

Coefficient Alpha Reliabilities for Three Item Clusters
Mathematics Assessment Questionnaire - Pilot Questionnaire

Psychological Construct	During Class	Working W/Others	Deskwork	Homework
Value	.513	.559	.499	.694
Interest	.490	.647	.703	.765
Confidence	.543	.498	.647	.640
Anxiety	.566	.575	.670	.439
Internal Learning Goals	.476	.362	.304	.493
External Performance Goals	.488	.499	.509	.453
Internal Stable Controllable	.383	.269	.314	.177
Internal Stable Uncontrollable	.522	.366	.402	.370
External Stable Uncontrollable	.313	.505	.501	.662
Unknown Control	.486	.653	.621	.611
Math as a Subject	-.198	.633	.211	.247
Self as an Active Learner (Form I)	.394	.320	.147	.035
Self as an Active Learner (Form II)	.443	.370	.274	.001
Self as an Active Learner (Form III)	.352	.375	.039	-.053

Table 3-11 (continued)

Psychological Construct	Taking a Test	Taking the City-Wide	Getting a Grade	Evaluation of Self
Value	.670	.578	.794	.002
Interest	.636	.520	.740	.725
Confidence	.676	.644	.772	.510
Anxiety	.696	.738	.456	.311
Internal Learning Goals	.519	.507	.517	.515
External Performance Goals	.326	.661	.433	a
Internal Stable Controllable	.436	.264	.454	.282
Internal Stable Uncontrollable	.517	.303	.433	.369
External Stable Uncontrollable	.618	.278	.676	.261
Unknown Control	.667	.624	.694	.677
Math as a Subject	.357	.247	.356	.545
Self as an Active Learner (Form I)	-.083	a	.228	a
Self as an Active Learner (Form II)	-.327	-.189	.449	.697
Self as an Active Learner (Form III)	-.199	-.305	.205	.590

Note: The negative alpha coefficients are a result of logical keying of the items.

[a] Items not included for this activity setting.

Working With Other Students, and Doing Homework. The decision was made to focus upon these settings because:

a. These settings were most significant for teachers in relation to planning instruction in daily classroom activities.

b. The Deskwork (seatwork) and Homework settings appeared to be closely related since both are individual work activities for students. It was therefore decided to retain only one of the individual settings, Homework.

c. The four Evaluation settings: Taking a Test, Getting a Grade, Taking the City-Wide Test and Evaluation of Self, were felt to represent a distinct grouping of items which could be examined as a separate unit. These settings were judged to be less central to planning on-going instructional activities.

Two psychological constructs, Mathematics as a Subject and Self as an Active Learner were not retained. An examination of the coefficient alpha reliabilities indicated limited consistency of responses to these statements. Further, the general items on the second form, that is the items which were not linked with a specific setting, were not included.

In summary, the final set of items which constitutes the Mathematics Assessment Questionnaire was based upon the analyses of the 1988 Pilot Questionnaire. A set of 161 statements and one question about how often the student works in a group with other students forms the revised booklet for the Mathematics Assessment Questionnaire. Appendix 3-1 presents the questionnaire booklet with each item classified for the constructs for which it was written.

CHAPTER IV

EVALUATION OF THE MATHEMATICS ASSESSMENT QUESTIONNAIRE: RELIABILITY AND VALIDITY RELATED EVIDENCE

In the fall of 1988, data were collected using the current form of the Mathematics Assessment Questionnaire. This chapter describes the administration, sample and analyses for evaluation of these data.

Administration and Sample Description

The Mathematics Assessment Questionnaire was administered to 2658 students in grades seven, eight and nine at eight New York City public schools. The criteria for selecting students and classes were that students read at the seventh-grade level and that the classes were not at the very top (gifted) or very bottom (low remedial) of the mathematics sections in the school. The MAQ booklets were administered during one 40 minute class period with project staff present. The class teacher read the instructions to the students. Students' questions were answered by either the classroom teacher or project staff.

Two hundred seven students were not included in the sample for analysis because they answered fewer than half the pages in the MAQ booklet. Of these 207 students, 64 were seventh-graders, 80 were eighth-graders and 63 were ninth-graders. The remaining sample of 2451 students is referred to as the "Total Sample." Although these 2451 students answered statements on at least eight of the 15 pages of the MAQ, many students omitted individual statements. The "Data Analysis Sample" included 1737 students who responded to all pages in the booklet. Although these students answered statements on all pages of the booklet, they did not necessarily respond to each statement. This results in different sample sizes for some analyses. Table 4-1 presents the sample sizes and average number of missing responses per student for both the Total Sample and Data Analysis Sample. For the Total Sample, the number of missing responses per student ranged from 0 to 114, with an average of 13.83 and a standard deviation of 23.08. For the Data Analysis Sample the number of missing responses per student ranged from 0 to 81, with an average of 2.08 (SD=5.32). Thus, students included in the Data Analysis Sample responded to an average of 159 statements out of the 161 statements included on the MAQ.

Table 4-2 presents the demographic information including grade, sex and age for the Total Sample (N=2451) and Data Analysis Sample (N=1737). The Total Sample and the Data Analysis Sample were similar in terms of these demographic indicators. For purposes of the data analyses in the remainder of this chapter the Data Analysis Sample

TABLE 4-1

Number of Students and Maximum Number of Missing Responses for the Total Sample and Data Analysis Sample by Grade

Grade	Total Sample (N=2451)		Data Analysis Sample (N=1737)	
	No. of students	Mean No. of missing responses per student	No. of students	Max. No. of missing responses per student
Seven	905	14.87	600	2.37
Eight	876	15.91	602	2.18
Nine	670	9.70	535	1.64
Total	2451	13.83	1737	2.08

was used. As Table 4-2 indicates, approximately one-third the students in this sample were in each of grades seven, eight and nine. Forty-four percent of the students were male, 56% female. The students ranged in age from 11 to 16 years, with the majority of students (93%) between 12 and 14 years of age. Self-reported ethnicity was: 8% Asian, 22% Black, 22% Hispanic, 43% White, 13% Other, and 2% not responding. The ethnic breakdown of students within the Total Sample (students who completed at least half the MAQ) and the Data Analysis Sample were similar.

In addition to collecting responses to the MAQ, students' mathematics achievement scores and reading achievement scores were obtained. During the spring prior to administration of the MAQ, students in New York City schools took the Metropolitan Achievement Test (MAT) - Mathematics test and the Degrees of Reading Power (DRP). These tests are given as part of a city-wide testing program in New York City. Both tests provide scaled scores and national percentiles normed for grade level. The MAT total mathematics scores were obtained. These are a composite of the student's subtest scores of concepts, computation and problem-solving. Achievement scores were available for

TABLE 4-2

Grade Level, Sex and Age of Students who Responded to the Mathematics Assessment Questionnaire
Total Sample and Data Analysis Sample

	Total Sample (N=2451)		Data Analysis Sample (N=1737)	
	N	Percentage	N	Percentage
Grade Level				
7	905	(36.9%)	600	(34.5%)
8	876	(35.7%)	602	(34.7%)
9	670	(27.4%)	535	(30.8%)
Sex				
Male	1131	(46.1%)	764	(44.0%)
Female	1309	(53.4%)	966	(55.6%)
No sex indicated	11	(.5%)	7	(.4%)
Age				
11 years	62	(2.5%)	38	(2.2%)
12 years	793	(32.4%)	538	(31.0%)
13 years	840	(34.3%)	605	(34.8%)
14 years	610	(24.9%)	466	(26.8%)
15 years	107	(4.4%)	69	(4.0%)
16 years	6	(.2%)	2	(.1%)
No age indicated	33	(1.3%)	19	(1.1%)

approximately 1500 students, or 87% of the students in the Data Analysis Sample. The largest number of missing achievement scores were for the ninth-grade students.

Table 4-3 presents the means and standard deviations of the national percentiles and scaled scores on each test by grade. The scaled scores used here for the DRP are the Mid Instructional Level. National percentiles on both scales ranged from 0 to 99. However, the overall mean national percentile for the sample was 67% on the MAT and 72% on the DRP. Thus, the sample with scores was above the 50th percentile on both tests.

For several analyses which are discussed below, separate high and low achieving groups in mathematics were constructed. The sample was dichotomized according to students' mathematics achievement, as defined by their national percentile on the Metropolitan Achievement Test. Based upon the pooled seventh, eighth, and ninth-grade data, the top 30% and bottom 30% of the students were selected. The mean MAT national percentile for the low group was 36.39, with a standard deviation of 12.13. This group included 460 students: 135 seventh-graders, 155 eighth-graders and 170 ninth-graders. The 457 high achievers included 167 seventh-graders, 207 eighth-graders, and 86 ninth-graders. The mean MAT national percentile of the high achievers group was 93.64%, with a standard deviation of 4.64.

Item Level Data Analyses

Appendix 4-1 presents response distributions for individual MAQ statements for the data analysis sample. Although items written to assess the affective beliefs, motivations and attributions were intended to be used in three item clusters, the first series of analyses examined the data at the individual item level. Several analyses were performed to assess whether responses of students in the three grades (seven, eight and nine) differed. Comparison of boys' and girls' responses were also included.

Differential Use of Item Response Categories by Sex

Research has shown differential use of responses such as "I don't know" by boys and girls for achievement test items on the National Assessment of Educational Progress (Linn, de Bendictis, Delucchi, Harris, & Stage, 1987; Suchner, 1990). Girls tend to use responses such as "I don't know" more often than boys. These findings suggest that the frequency with which boys and girls respond MAYBE to the Metacognitive statements or SORT OF TRUE to the Self-Regulatory, affective belief, motivation and attribution statements also might differ. The responses were compared for boys and girls.

TABLE 4-3

Means and Standard Deviations of MAT and DRP
National Percentiles and Scaled Scores by Grade

Achievement Score	Grade Level 7	8	9	All Three Grades Combined
MAT National Percentile				
Mean	68.61	70.08	60.37	66.81
SD	23.19	24.62	23.70	24.19
N	537	544	425	1506
Range	0-99	7-99	10-99	0-99
MAT Scaled Scores				
Mean	663.79	683.55	679.42	675.35
SD	33.98	46.29	32.50	39.49
N	535	544	425	1504
Range	575-757	595-788	614-797	575-797
DRP National Percentile				
Mean	71.30	74.19	68.49	71.56
SD	18.82	14.94	16.91	17.12
N	547	535	413	1495
Range	0-90	21-91	2-90	0-91
DRP Mid-Instructional Level (Scaled Scores)				
Mean	62.90	70.69	71.61	68.13
SD	9.57	9.49	10.16	10.48
N	562	558	436	1556
Range	27-95	40-90	30-99	27-99

Metacognitive Statements - MAYBE and YES Responses

The total number of times each student responded MAYBE to the 20 Metacognitive statements was examined. The number of MAYBE responses per student ranged from 0 to 14, with an average of 2.76 MAYBE responses per student (SD=2.46). Three hundred seventy eight students (22%), never used the

MAYBE category -- 165 boys and 211 girls, 22% of each sex. Only seven boys (1%) and ten girls (1%) used the MAYBE response 10 or more times. A t-test was performed to compare the mean number of times MAYBE was selected by boys (M=2.80, SD=2.51) and girls (M=2.72, SD=2.41). The difference was not statistically significant (t (1728) = .66).

The total number of times each student responded YES was also examined. The number of YES responses per student ranged from 0 to 19, with an average of 10.58 YES responses per student (SD=3.12). Five students (.3%), never used the YES category. A t-test was performed to compare the mean number of times YES was selected by boys (M=10.22, SD=3.04) and girls (M=10.86, SD=3.15). A statistically significant difference was found (t (1728) = -4.25, $p < .001$). Although differences in the use of the YES category were statistically significant, the differences were small and the sample size is large. Therefore, based upon these analyses it was concluded that boys and girls did not meaningfully differ in their use of either the MAYBE or YES category.

Self-Regulatory Statements - SORT OF TRUE Responses

The total number of times each student responded SORT OF TRUE to the Self-Regulatory statements within each activity setting was examined. SORT OF TRUE is the middle category on the one to five rating scale. It might be interpreted similarly to an "I don't know" option, a student who chooses to not commit to a response. Table 4-4 presents the mean number of times boys, girls and the total data analysis sample selected SORT OF TRUE within each setting. The number of SORT OF TRUE responses to the 19 Self-Regulatory statements in the During Class setting ranged from 0 to 16 per student. Eighty-three (5%) of the students never used the middle response category. For the 23 statements in the Working With Other Students setting, students responded sort of true between 0 and 23 times. One hundred twenty-seven (7%) of the students never responded SORT OF TRUE to any of the 23 statements in this setting. The Homework setting included nine Self-Regulatory statements and students responded SORT OF TRUE between 0 and 9 times. In this setting, the middle response category was never used by 431 (25%) of the students.

To examine whether girls selected the SORT OF TRUE category more often than boys, t-tests were performed. In the During Class setting, use of the response did not differ between boys' (M=4.34) and girls' (M=4.32), t (1728) = .18. In the Working With Other Students setting the difference between boys (M=5.06) and girls (M=5.27) was not statistically significant (t (1728) = -1.27). The t-test comparing boys' (M=1.72) and girls' (M=1.68) use of the SORT

TABLE 4-4

Mean Number of Times Boys, Girls and the Total Data Analysis Sample Selected SORT OF TRUE in Response to Self-Regulatory Items Within Activity Settings

Activity Setting	Boys (764)	Girls (966)	Total (1737)[a]
During Class (19 items)			
Mean	4.34	4.32	4.33
SD	2.47	2.41	2.44
Working With Other Students (23 items)			
Mean	5.06	5.27	5.19
SD	3.45	3.56	3.51
Homework (9 items)			
Mean	1.72	1.68	1.70
SD	1.55	1.54	1.55

[a] Total includes seven students not identified by sex

OF TRUE responses in the Homework setting was also not statistically significant (t (1728) = .53). Thus, overall, there were no differences in the use of the middle response category by girls and boys.

Affective Belief, Motivation and Attribution Statements - SORT OF TRUE Responses

The total number of times each student responded SORT OF TRUE to the three statements for each psychological construct within each activity setting was examined. The number of SORT OF TRUE responses within any construct by setting could range from 0 to 3, with the exception of the Internal Learning Goals, Homework setting. This construct within the Homework setting included only two items.

Tables 4-5 through 4-7 present the mean number of times boys, girls and the total data analysis sample selected SORT OF TRUE within each setting. In general, girls used this middle category more often than boys. Yet, the absolute mean difference between boys and girls usage on any construct within in any activity setting did not exceed .16.

To compare boys' and girls' use of the SORT OF TRUE category, t-tests were performed, using .005 as the level of significance. In the During Class setting, two statistically significant differences were found. Girls selected the SORT OF TRUE more often than boys for the Confidence statements (girls, M=.75, boys M=.58, $t(1728) = -4.15$, $p < .001$) and for the Anxiety statements (girls, M=.71, boys M=.59, $t(1728) = -3.20$, $p < .005$). In the Working with Other Students setting, differences between boys' and girls' use of the category were found for two constructs: Confidence (girls M=.74, boys M=.61, $t(1728) = -3.47$), $p < .005$) and Internal Learning Goals (girls M=.82, boys M=.70, $t(1728) = -.2.89$, $p < .005$). In both cases girls more frequently than boys selected the SORT OF TRUE response option. In the Homework setting, girls more often than boys selected the SORT OF TRUE response to the External Stable Uncontrollable statements (girls M=.81, boys M=.67, $t(1728) = -3.54$, $p < .0001$).

Overall, while one or two constructs in each activity setting had statistically significant differences in use of the SORT OF TRUE category by girls and boys, the use of the category was more similar than different.

Sex by Grade Level Comparisons - Anovas

Separate two (sex) by three (grade) way analyses of variance, Anovas, were performed using the individual Self-Regulatory, Affective Belief, Motivation and Attribution statements as the dependent variables. Since a total of 141 analyses were performed, the level of significance was set at $p \leq .0004$. In the following sections, the Self-Regulatory statements are discussed first, and then the affective beliefs, motivations and attributions.

Self-Regulatory Statements

Interactions: No interactions between sex and grade were statistically significant.

Main effect for Sex: Across the 51 Self-Regulatory statements within all settings, 13 statements had a main effect for sex. The differences between the means of the boys' and girls' responses did not exceed .34 for any item, and averaged .23, on the five point response scale. In all but one comparison, girls reported more Self-Regulatory

TABLE 4-5

Mean Number of Times Boys, Girls and the Total Data Analysis Sample Selected SORT OF TRUE in Response to the Three Items Assessing the Ten Psychological Constructs Within the <u>During Class</u> Activity Setting

Psychological Constructs	Boys (N=764)	Girls (N=966)	Total (N=1737)
Value			
Mean	.687	.748	.725
SD	.783	.790	.789
Interest			
Mean	.687	.767	.731
SD	.746	.795	.775
Confidence			
Mean	.584	.746	.675
SD	.761	.845	.813
Anxiety			
Mean	.592	.711	.660
SD	.730	.803	.773
Internal Learning Goals			
Mean	.778	.765	.773
SD	.810	.810	.810
External Performance Goals			
Mean	.524	.500	.510
SD	.682	.658	.668
Internal Stable Controllable			
Mean	.783	.819	.803
SD	.838	.865	.852
Internal Stable Uncontrollable			
Mean	.789	.851	.824
SD	.837	.857	.848
External Stable Uncontrollable			
Mean	.712	.724	.721
SD	.765	.775	.772
Unknown Control			
Mean	.467	.521	.498
SD	.715	.769	.745

TABLE 4-6

Mean Number of Times Boys, Girls and the Total Data Analysis Sample Selected SORT OF TRUE in Response to the Three Items Assessing the Ten Psychological Constructs Within the Working With Other Students Activity Setting

Psychological Constructs	Boys (N=764)	Girls (N=966)	Total (N=1737)
Value			
Mean	.734	.713	.723
SD	.791	.783	.785
Interest			
Mean	.696	.716	.709
SD	.835	.816	.825
Confidence			
Mean	.605	.736	.678
SD	.756	.803	.785
Anxiety			
Mean	.605	.637	.623
SD	.748	.753	.751
Internal Learning Goals			
Mean	.696	.819	.765
SD	.824	.914	.877
External Performance Goals			
Mean	.505	.512	.511
SD	.705	.678	.690
Internal Stable Controllable			
Mean	.751	.797	.778
SD	.828	.860	.846
Internal Stable Uncontrollable			
Mean	.853	.905	.884
SD	.885	.879	.883
External Stable Uncontrollable			
Mean	.715	.771	.746
SD	.822	.845	.820
Unknown Control			
Mean	.588	.588	.589
SD	.777	.769	.773

TABLE 4-7

Mean Number of Times Boys, Girls and the Total Data Analysis Sample Selected SORT OF TRUE in Response to the Three Items Assessing the Ten Psychological Constructs Within the Homework Activity Setting

Psychological Constructs	Boys (N=764)	Girls (N=966)	Total (N=1737)
Value			
Mean	.694	.716	.708
SD	.792	.803	.798
Interest			
Mean	.843	.878	.864
SD	.907	.927	.918
Confidence			
Mean	.556	.621	.592
SD	.768	.775	.772
Anxiety			
Mean	.614	.671	.645
SD	.769	.805	.789
Internal Learning Goals			
Mean	.740	.857	.806
SD	.844	.905	.880
External Performance Goals			
Mean	.702	.694	.700
SD	.818	.796	.809
Internal Stable Controllable			
Mean	.865	.952	.914
SD	.934	.926	.930
Internal Stable Uncontrollable			
Mean	.368	.364	.366
SD	.665	.674	.669
External Stable Uncontrollable			
Mean	.666	.806	.744
SD	.790	.839	.820
Unknown Control			
Mean	.614	.677	.649
SD	.769	.820	.799

behaviors than boys. The item on which boys reported greater self-regulatory behaviors was in the Homework setting.

In the During Class setting, a main effect for sex was found for five of the 19 Self-Regulatory statements. These are items numbered 10, 15, 17, 18 and 19 on page 6 in Appendix 3-1. In this setting, the difference between the means of the boys' and girls' responses never exceeded .28, and averaged .21. Six out of 23 Self-Regulatory items in the Working With Other Students setting had a statistically significant main effect for sex (numbered 10, 13, 14, 15, 16 and 17 on page 11 in Appendix 3-1). Of these, only one difference between the means exceeded .25 ("We check each other's ideas"), and had an absolute mean difference of .34. In the Homework setting, two out of nine Anovas had a statistically significant main effect for sex. These are items 2 and 4 on page 15 in Appendix 3-1. The only item which boys (M=2.99) reported was more true than girls (M=3.27) was in the Homework setting: "I decide how much time to spend on my math homework word problems."

Main effect for Grade: Four main effects for grade were statistically significant for the Self-Regulatory statements. Two differences were found for the 19 statements of the During Class setting, (items numbered 12 and 13 on page 6 in Appendix 3-1), and two differences for the 23 statements of the Working With Other Students setting, (items numbered 10 and 11 on page 11 in Appendix 3-1). In the During Class setting, the largest difference was between the ninth-graders who reported greater endorsement of the Self-Regulatory statements than the eighth-graders.

Affective Belief, Motivation and Attribution Statements

Interactions: No interactions between sex and grade were statistically significant.

Main effect for Sex: Examination of the Anovas for the individual affective belief, motivation and attribution items within the During Class setting revealed that out of 30 comparisons of items, there were nine statistically significant main effects for sex. These are for items numbered 20, 22, 25, 35, 37, 41, 44, 46, and 49 on pages 7 through 9 in Appendix 3-1. The largest mean difference was .47, for an Internal Learning Uncontrollable statement ("If I can follow my teacher's explanation for word problems, it is because I am smart"). Boys reported this statement was more true than girls. Sixteen of the 30 Anovas for statements within the Working With Other Students setting had a statistically significant main effect for sex (Items numbered 24, 25, 26, 28, 35, 37, 40, 41, 42, 43, 44, 45, 46, 47, 49, and 52 on pages 12 through 14 in Appendix 3-1). On

all three items which assess Unknown Control, boys reported less of a sense of control. Within the Homework setting, 11 main effects for sex were found (Items numbered 12, 14, 15, 16, 22, 23, 24, 29, 33, 36, 39 on pages 16 though 18 in Appendix 3-1). Sex differences were found in response to all three items written to assess the construct External Performance Goals. Boys rated the statements in all three settings as more true than girls.

Main effect for Grade: Ten statistically significant main effects for grade on the affective belief, motivation and attribution items were found for statements within the During Class setting. These are items 20, 21, 23, 26, 30, 34, 35, 40, 46, and 49 on pages 7 though 9 in Appendix 3-1. The only other difference was for a statement in the Homework setting, item numbered 22. The difference in means ranged from .24 to .39 with an average difference of .33.

Comparisons of Within Grade Correlations

Pearson correlations among individual items were compared across grades to further investigate differences in responses patterns. In order for a difference between grades to be considered meaningful, the following criterion was set: the difference between any two of the three possible pairs of correlations (seventh vs. eighth, seventh vs. ninth, or eighth vs. ninth) had to be greater than .20. The comparisons were done separately for statements included within the During Class, Working With Other Students and Homework settings. No differences met the criteria.

An example of a correlation which differed most across the three grades in the During Class setting is between statements 33 and 20. Statement 33 is, "I usually do not know what is going on when my teacher is explaining a word problem," and statement 20 is, "I feel confident that I will be able to follow any word problem my math teacher explains in class." Correlations of the responses to the two statements were: Grade 9: r= -.32, grade 8: r= -.25, and grade 7: r= -.13. Based upon the results of both the Anovas and correlation analyses, it was decided the grade-level data would be pooled for most analyses.

Construct Level Data Analyses

Although there are no scores reported for the Metacognitive and Self-Regulatory statements, several analyses were performed to examine response consistency. Coefficient alpha reliabilities were computed for the Metacognitive and Self-Regulatory statements as they were grouped in the MAQ: before, during or after the activity. The alpha coefficients for the affective beliefs, motivations and attributions were calculated based upon the three items within each cluster for each setting.

Internal Consistency Estimates

Metacognitive Statements

Alpha reliability coefficients were computed for the Metacognitive statements as grouped on the MAQ: before, during and after working the word problem. These are presented in Table 4-8. The coefficients were modest, ranging from .35 to .52. These alphas indicate that the hypothesized categories based upon when the activity was performed (before, during or after working the problem) were not homogeneous. Therefore, factor analyses of the statements were examined to determine if more homogeneous clusters of the Metacognitive statements could be identified. (See the section on factor analyses below.)

TABLE 4-8

Coefficient Alpha Reliabilities for the Metacognitive Items as Grouped on the Mathematics Assessment Questionnaire

(N=1612)

Metacognition	Before Working	As Working	After Working	Strategies
Item numbers	1 - 7	8 - 11	12 - 16	17 - 20
Alpha	.351	.402	.521	.394

Self-Regulatory Statements

The Self-Regulatory statements within each of the three settings were grouped into three categories: planning and goal setting (before), monitoring progress and keeping track (during) and judging, evaluating and reviewing (after). Alpha reliability coefficients based upon items within each of the categories within each setting are presented in Table 4-9. All coefficients exceeded at least .50, ranging from .51 to .84. In general, items in the Working With Other Students setting were the most internally consistent.

TABLE 4-9

Coefficient Alpha Reliabilities for the Self-Regulatory Items as Grouped on the Mathematics Assessment Questionnaire

	Activity Setting		
Self-Regulatory	During Class (N=1628)	Working With Others (N=1538)	Homework (N=1679)
Planning and Goal Setting			
Item numbers	1 - 6	1 - 7	1 - 3
Alpha	.580	.790	.512
Monitoring Progress			
Item numbers	7 - 14	8 - 15	4 - 6
Alpha	.631	.818	.735
Judging, Evaluating and Reviewing			
Item numbers	15 - 19	16 - 23	7 - 9
Alpha	.794	.845	.587

Like the Metacognitive statements, students' responses to the Self-Regulatory items were factor analyzed. Separate factor analyses were performed for items within each setting.

Affective Belief, Motivation and Attribution Statements

The MAQ includes three statements to assess each psychological construct within each of the three activity settings. Coefficient alpha reliabilities were calculated to estimate the internal consistency of responses to statements within each cluster.

The coefficient alphas are presented in Table 4-10. All coefficients are based upon three items with one exception. Examination of the item-total correlations within the Internal Learning Goals in the Homework setting revealed a negative correlation for Item 15. When item 15 ("I do not like to do word problems for homework unless I can learn something new by doing them.") was logically keyed in the same direction as the other two statements: "I like to do hard homework word problems because I learn more math by working them," and "I like to do challenging word problems for homework because solving them helps me learn math," the coefficient alpha reliability was .386. However, statistically reversing the scoring increased the consistency among responses to the three statements. That is, the coefficient alpha reliabilities increased from .386 (logical scoring) to .446 (statistical scoring). Since the logical keying and statistical keying did not agree, item 15 was eliminated. Using the two item cluster resulted in an alpha coefficient of .737. All further analyses for Internal Learning Goals in the Homework setting are based upon the two item cluster.

Examination of Table 4-10 reveals that the median coefficient is .61 and all but three coefficient alpha reliabilities exceeded .40. The three exceptions are:

Value - Working With Other Students (r_{tt} =.394)
Interest - During Class (r_{tt} =.335)
External Performance Goals - During Class (r_{tt} =.203)

Responses to the statements addressing External Performance Goals within the During Classroom setting were the least consistent, with a coefficient alpha reliability of .203. The cluster of statements addressing External Performance Goals within the other two settings had a coefficient alpha reliability of .532 (Working With Other Students) and .543 (Homework). Thus, only within the During Class setting did student responses to the three item cluster assessing External Performance Goals appear to be inconsistent. The correlations for this three item cluster indicated heterogeneity among the statements. Examination of the content of the External Performance Goals items within the During Class setting suggests that the items differ in terms of the types of external motivators and the student behaviors examined.

TABLE 4-10

Coefficient Alpha Reliabilities for the Three Item Clusters of Psychological Constructs Within Each Activity Setting

Psychological Construct	Activity Setting: During Class (N=1358)	Working With Others (N=1270)	Homework (N=1405)
Value			
Item numbers	26[r] 28 34	32 44 46[r]	12[r] 20 39[r]
Alpha	.500	.394	.483
Interest			
Item numbers	24 44[r] 49	30 36 40[r]	18 34[r] 28
Alpha	.335	.487	.725
Confidence			
Item numbers	20 31[r] 48[r]	24 27[r] 48	13[r] 22 35[r]
Alpha	.548	.412	.611
Anxiety			
Item numbers	27 35[r] 39	25 31[r] 51	19 26[r] 36[r]
Alpha	.576	.520	.451
Internal Learning Goals			
Item numbers	30 32 42	29 33 39	31 23[a]
Alpha	.710	.698	.737
External Performance Goals			
Item numbers	25 36 40	37 43 53	14 33 29
Alpha	.203	.532	.543
Internal Stable Controllable			
Item numbers	43 45 47	34 41 49	17 25 37
Alpha	.620	.610	.605

TABLE 4-10 (continued)

Internal Stable Uncontrollable			
Item numbers	22 37 41	26 38 52	10 16 38
Alpha	.593	.620	.730
External Stable Uncontrollable			
Item numbers	23 29 46	35 50 45	21 32 27
Alpha	.418	.613	.603
Unknown Control			
Item numbers	21 33 38	28 42 47	11 30 24
Alpha	.683	.588	.661

[a] two item cluster. Inclusion of 3rd item, number 15 with logical keying r_{tt}=.386, with statistical keying r_{tt}=.446 - two items were retained.
[r] items with reversed scoring.

The three External Performance Goal items are:

25. I only answer questions about word problems in math class to please my teacher.

36. I pay attention when my teacher explains word problems if I know I will have a test on them.

40. I volunteer to do a word problem on the board if I think it will help my grade.

The coefficient alpha reliability for statements addressing Interest in working word problems During Class was .335. The three-item Interest clusters were somewhat more consistent in the other settings: .487 in the Working With Other Students setting, and .725 in the Homework setting.

Comparisons Across Settings

Additional coefficient alpha reliabilities were computed using items combined for pairs of activity settings: During Class and Working With Other Students, During Class and Homework, and Working With Other Students and Homework. For example, a coefficient was computed using six Confidence statements - three from the During Class setting and three

from the Homework setting. Similarly, the reliability estimates were computed using statements from both the During Class and Working With Other Students settings, and the Working With Other Students setting and Homework setting. Finally, the coefficient alpha reliabilities were also computed for the total of nine statements written for a given construct combined across these settings.

Table 4-11 presents the coefficient alpha reliabilities for statements combined for settings. A comparison was made of the coefficients for the pairs or total settings for which the value of the coefficients stayed the same (within .01) or was lower than one of the individual settings coefficients. Twelve of the 30 alphas for the combined pairs of settings are the same or lower than one of the individual cluster alphas, as are two of the alphas for all three settings combined (Interest and Internal Stable Uncontrollable). The construct of Interest is not homogeneous when the settings are paired, nor are the constructs of External Performance Goals and three of the four attribution constructs (ISC, ISU, ESU).

Thus, including statements from more than one activity setting increases the coefficient in some cases, decreases it in others, and makes no difference in others. These results may indicate an interaction between setting and affective beliefs, motivations and attributions. In some cases, assessing the constructs in different settings provides additional information but the effect is not consistent for each setting.

The coefficients alpha reliabilities based upon the nine items (combining the three settings) are generally higher than the coefficients based upon a single setting with three items. The coefficient alpha reliabilities based upon all settings appear to include variance which is unique to the construct, and common across the settings. With nine items, the reliability estimates would be expected to increase, regardless of the effect of the setting. However, compared to the paired six item alphas, the increase was not substantial, suggesting that variance associated with the setting adds unique variance. Only in two cases, Value and Unknown Control, did the nine items have higher alphas than the six item pairs.

Table 4-11 also presents the Spearman-Brown estimates for individual settings increasing the number of items to six - or four as with the Internal Learning Goals in the Homework setting. The Spearman Brown estimates were calculated to provide an indication of the theoretical ceiling for the alphas of the combined six item clusters. If there is variance unique to each cluster, the coefficients for the pairs should will be lower than the either of the Spearman-Brown estimates.

TABLE 4-11

Coefficient Alpha Reliabilities for the Three Item Clusters Combined Across Activity Settings and Spearman-Brown (SB) Estimates for Individual Settings

Psychological Construct	Activity Settings: During Class & With Others	During Class & Homework	With Others & Homework	All 3 Settings Combined
Value				
Alpha	.614	.682	.640	.730
SB	.667-.565	.667-.651	.565-.651	
Interest				
Alpha	.497	.727	.678	.717
SB	.502-.655	.502-.841	.655-.841	
Confidence				
Alpha	.611	.745	.660	.752
SB	.708-.583	.708-.758	.583-.758	
Anxiety				
Alpha	.589	.674	.563	.682
SB	.731-.684	.731-.622	.684-.622	
Internal Learning Goals				
Alpha	.794	.767 [a]	.754 [a]	.822
SB	.831-.823	.831-.849	.823-.849	
External Performance Goals				
Alpha	.471	.554	.652	.653
SB	.338-.695	.338-.704	.695-.704	
Internal Stable Controllable				
Alpha	.539	.750	.562	.670
SB	.766-.758	.766-.754	.758-.754	
Internal Stable Uncontrollable				
Alpha	.741	.368	.515	.604
SB	.744-.766	.744-.844	.766-.844	

TABLE 4-11 (continued)

External Stable Uncontrollable				
Alpha	.604	.592	.729	.715
SB	.590-.760	.590-.753	.760-.753	
Unknown Control				
Alpha	.717	.756	.737	.797
SB	.812-.740	.812-.796	.740-.796	

[a] In the Homework setting, based upon a two item cluster.

A comparison of the pair alphas and the Spearman-Brown estimates revealed that thirteen of the alphas of the pairs were within the range of the two Spearman-Brown estimates. Only one was higher--Value for the pair During Class and Homework. However, thirteen of the pairs of coefficient alphas were lower than both Spearman-Brown estimates. This further suggests the unique contribution of the activity setting. The majority of these pairs (10 of the 13) involve the Working With Other Students activity setting; seven involve During Class; and nine involve Homework.

Further analyses using multidimensional scaling and repeated measures multivariate analyses of variance, also substantiate the conclusion of variance specific to activity settings. Assessing the constructs in the context of an activity setting adds unique variance (Tittle & Hecht, 1990; Tittle, Weinberg & Hecht, 1990).

Comparisons by Grade Level

Alpha reliability estimates were also computed for the seventh, eighth and ninth-grade students separately. These are presented in Tables 4-12 through 4-14. Examination of these coefficients indicates that some clusters are more reliable in one grade than another. However, there is no consistent pattern of increased or decreased reliability for any particular grade.

In general, the absolute differences in the coefficients between any two grades are small. Only four differences are greater than .10, with only one greater than .20. The largest difference is between grades in response to statements concerning Anxiety while doing Homework. Responses of the seventh-grade students were the least internally consistent (r=.305) while responses of the ninth

TABLE 4-12

Coefficient Alpha Reliabilities by Grade for the Psychological Constructs Within the During Class Activity Setting

Psychological Construct	Grade Level 7 (N=442)	8 (N=482)	9 (N=434)	Total (N=1358)
Value	.477	.484	.519	.500
Interest	.295	.346	.344	.335
Confidence	.455	.585	.597	.548
Anxiety	.593	.605	.524	.576
Internal Learning Goals	.711	.692	.726	.710
External Performance Goals	.166	.168	.281	.203
Internal Stable Controllable	.650	.633	.567	.620
Internal Stable Uncontrollable	.539	.601	.632	.593
External Stable Uncontrollable	.429	.436	.382	.418
Unknown Control	.639	.707	.703	.683

TABLE 4-13

Coefficient Alpha Reliabilities by Grade for the Psychological Constructs Within the Working With Other Students Activity Setting

Psychological Construct	Grade Level 7 (N=418)	8 (N=447)	9 (N=405)	Total (N=1270)
Value	.403	.352	.419	.394
Interest	.474	.475	.514	.487
Confidence	.419	.452	.354	.412
Anxiety	.518	.507	.535	.520
Internal Learning Goals	.693	.642	.757	.698
External Performance Goals	.554	.533	.506	.532
Internal Stable Controllable	.585	.611	.638	.610
Internal Stable Uncontrollable	.627	.647	.580	.620
External Stable Uncontrollable	.594	.642	.601	.613
Unknown Control	.618	.566	.577	.588

TABLE 4-14

Coefficient Alpha Reliabilities by Grade for the Psychological Constructs Within the Homework Activity Setting

Psychological Construct	Grade Level			
	7 (N=480)	8 (N=488)	9 (N=437)	Total (N=1405)
Value	.437	.484	.534	.483
Interest	.716	.715	.744	.725
Confidence	.593	.589	.652	.611
Anxiety	.305	.480	.564	.451
Internal[a] Learning Goals	.708	.710	.799	.737
External Performance Goals	.524	.602	.493	.543
Internal Stable Controllable	.580	.622	.613	.605
Internal Stable Uncontrollable	.708	.715	.771	.730
External Stable Uncontrollable	.584	.595	.633	.603
Unknown Control	.676	.658	.640	.661

[a] two item cluster

grade students were the most consistent (r=.564). Based upon an examination of the reliability coefficients, it was decided that the three item clusters are not meaningfully or consistently more reliable or unreliable within one grade than another.

Student Level Analyses

Several data analyses were performed to examine student level responses to the Mathematics Assessment Questionnaire statements. These analyses examined the dimensionality of the various constructs using factor analyses and discriminant function analyses. In the following discussion the analyses are grouped according to the construct examined.

Metacognitive Statements

Factor Analysis: Four Factor Solution

The 20 Metacognitive statements were subjected to a principal axis factor analysis with varimax rotation. Eigenvalues greater than 1 and a scree test were used as criteria to determine the number of factors to retain. Although the two, three, and four factor solutions were examined, the four factor solution provided the most interpretable results from a theoretical perspective. The four factor solution accounted for 22.3% of the variance. Table 4-15 presents the factor loadings following the orthogonal rotation. Although the factor loadings following the oblique rotation were also examined, the interpretations based upon both rotations were similar.

Factor loadings greater than .30 were examined to help interpret the factors. These loadings are in bold face in Table 4-15. The four factors can be roughly characterized as grouping together general problem-solving approaches and problem-solving strategies, as well as processing activities that occur before, during and after solving the nonroutine mathematical word problem used in the Mathematics Assessment Questionnaire.

> Awareness of general problem solving approaches and strategies: The first factor includes statements or prompts concerning general approaches and problem-solving strategies. It includes a general statement, "I felt confused and could not decide what to do." The statement, "I drew a picture to help me understand the problem," has a negative loading on this factor. This statement describes a "natural strategy" for the specific mathematical problem which the students worked. It seems to indicate that those students who used this strategy were effective problem-solvers: they

TABLE 4-15

Factor Loadings for the Metacognitive Statements:
Four Factor Solution

(N=1612)

Metacognitive Statements	Factor Loadings I	II	III	IV
20. I felt confused and could not decide what to do.	**.615**	.053	.015	-.041
18. I "guessed and checked."	**.462**	-.036	-.033	.008
4. I tried to remember if I had worked a problem like this before.	**.364**	.029	-.008	.284
16. I thought about a different way to solve the problem.	**.330**	-.022	.046	.160
12. I looked back to see if I did the correct procedures.	-.076	**.589**	.107	.123
13. I checked to see if my calculations were correct.	-.104	**.564**	.045	.146
14. I went back and checked my work again.	.086	**.547**	.141	.079
11. I checked my work step-by step as I worked the problem.	-.087	**.465**	.217	.206
15. I looked back at the problem to see if my answer made sense.	.123	**.307**	-.014	**.310**
9. I kept looking back at the problem after I did a step.	-.006	.120	**.459**	.040
10. I had to stop and rethink a step I had already done.	**.303**	.060	**.384**	.034
17. I drew a picture to help me understand the problem.	**-.347**	-.002	**.368**	-.158

TABLE 4-15 (Continued)

19. I picked out the operations I needed to do this problem.	.065	.131	-.005	**.478**
6. I asked myself, Is there information in the problem that I don't need?	.107	.044	.027	**.371**
5. I thought about what information I needed to solve this problem.	-.056	.209	.066	**.360**
8. I thought about all the steps as I worked the problem.	-.031	.197	.195	**.321**
1. I read the problem more than once.	.041	.173	.254	.042
2. I thought to myself, Do I understand what the question is asking me?	.023	.139	.141	.191
3. I tried to put the problem into my own words.	.181	.034	-.001	.242
7. I wrote down important information.	-.192	.044	.274	.188

Bold type indicates loadings above .30.
Percentage of variance accounted for: 22.3%

were clear that they did not use "guess and check" nor were they confused when working the problem.

Awareness of checking activities: Statements with loadings greater than .30 on the second factor focus upon checking activities engaged in after and during working the problem. Examples of statements are, "I looked back to see if I did the correct procedures," and "I checked my work step by step as I did the problem."

Awareness of monitoring activities: The third factor includes statements related to monitoring activities engaged in during the working of the problem. An example is, "I kept looking back at the problem after I did a step."

Awareness of planning activities: Statements included on the fourth factor focus upon planning activities in preparation for problem-solving. Examples are, "I thought about what information I needed to solve this problem," and "I picked out the operations I needed to do this problem." These statements may cluster here since they tend to be less applicable to the particular nonroutine problem used in the MAQ.

Four prompts did not have loadings greater than .30 on any of the four factors: 1) "I read the problem more than once;" 2) "I thought to myself, Do I understand what the problem is asking me?" 3) "I tried to put the problem into my own words," and 4) "I wrote down important information." The first statement had a very high percentage of "yes" responses, and therefore less variance. Even though the statements had been reviewed with students during individual interviews, the second and third statements may not be meaningful to students given the specific problem solved. Although the fourth statement "I wrote down important information," did not have any loading above .30, its highest loading, .27, as expected, was on the monitoring activities factor.

It is likely that the pattern of meaningful loadings for the Metacognitive statements would shift as a function of the task requirements. In particular, if students solve a word problem which is dependent upon knowledge of a specific mathematical topic, different clusters might be obtained depending upon the mathematical experiences of the students.

Factor Analysis: Two Factor Solution

Although the four factor solution was the most meaningful from a theoretical perspective, from an empirical perspective the two factor solution can be useful. The first four eigenvalues based upon the common factor model were: 2.15, 1.29, .584, and .440. Thus, using the scree test as a guide, the two factor model is more appropriate or useful. The two factor solution accounted for 16.7% of the variance.

Table 4-16 presents the factor loadings based upon the two factor model. Examination of factor loadings greater than .30 suggests that the two factors which emerged are similar to the first two factors which were found (in reverse order) based upon the four factor solution.

Awareness of monitoring and checking of the problem-solving process: The first factor includes statements with loadings greater than .30 which focus upon monitoring and checking activities engaged in during

TABLE 4-16

Factor Loadings for the Metacognitive Statements:
Two Factor Solution

(N=1612)

Metacognitive Statements	Factor Loadings	
	I	II
11. I checked my work step-by-step as I worked the problem.	**.565**	-.037
12. I looked back to see if I did the correct procedures.	**.560**	-.047
13. I checked to see if my calculations were correct.	**.532**	-.055
14. I went back and checked my work again.	**.492**	.077
8. I thought about all the steps as I worked the problem.	**.385**	.073
15. I looked back at the problem to see of my answer made sense.	**.367**	.229
5. I thought about what information I needed to solve the problem.	**.366**	.078
19. I picked out the operations I needed to do this problem.	**.310**	.231
9. I kept looking back at the problem after I did a step.	.269	-.035
2. I thought to myself, Do I understand what the problem is asking me?	.251	.079
7. I wrote down important information.	.248	-.123
1. I read the problem more than once.	.244	.021
20. I felt confused and could not decide what to do.	-.135	**.515**
4. I tried to remember if I had worked a problem like this before.	.105	**.455**

TABLE 4-16 (Continued)

18.	I "guessed and checked."	-.103	**.430**
17.	I drew a picture to help me understand the problem.	.102	**-.388**
16.	I thought about a different way to solve the problem.	.029	**.369**
3.	I tried to put the problem into my own words.	.117	.264
6.	I asked myself, Is there information in this problem that I don't need?	.205	.237
10.	I had to stop and rethink a step I had already done.	.155	.226

Bold type indicates loadings above .30
Percentage of variance accounted for: 16.7%

and after working the problem. Examples of statements are "I looked back to see if I did the correct procedures," and "I checked my work step by step as I did the problem."

Awareness of general problem solving approaches and strategies: The second factor includes the statements "I felt confused and could not decide what to do" as well as the statement, "I guessed and checked." There is a negative weight for "I drew a picture to help me understand the problem," a natural strategy for the nonroutine problem which students worked. This bipolar factor appears to indicate awareness of and successful problem solving strategies versus confusion and unsuccessful problem solving strategies.

Factor Analysis of Subgroups - Sex and Achievement

To help further examine the factor structure of the MAQ Metacognitive statements, several additional factor analyses were performed. The 20 items were factor analyzed along with the indicators of mathematics achievement (MAT) and reading achievement (DRP).

The 20 Metacognitive statements and the national percentile rank scores on the Metropolitan Achievement Test were factor analyzed. Due to missing MAT national percentiles, the sample for this analysis was 1402 students.

The two factor solution accounted for 16.7% of the variance. Although the factor loadings following both the orthogonal and oblique rotation were examined, the interpretations were almost identical. The national percentile on the MAT had a negative loading of -.417 on the bipolar factor (Factor 2, page 29) which assessed general problem-solving approaches and strategies. The item "I drew a picture to help me understand the problem," also had a negative loading on this factor.

The indicator of reading achievement, the national percentile on the Degrees of Reading Power, was also factor analyzed with the Metacognitive statements. The sample size for this analysis was 1391. The two factor solution, which accounted for 16.5% of the variance, was similar to that obtained when the MAT was included in the analysis. The DRP national percentile had a negative loading of -.440 on the factor which assessed strategies and problem solving approaches. Thus, higher scores on both the math and reading tests were not associated with responses indicating perceptions of confusion about the problem solving process.

To help assess whether the factor structures differed for different subgroups of the sample, a series of factor analyses were performed. Specifically, the factor structures of the following subgroups were examined: boys, girls, low mathematics achieving students, and high mathematics achieving students. (Classification procedures for identifying the high and low achievers are described on page IV-4.)

The factor structure based upon the responses of 710 male students was nearly identical to the structure based upon the responses of 896 female students. The two factor solution accounted for 15.9% of the variance in the boys' responses and 17.8% of the variance in the girls' responses. Similar factor structures were also found based upon separate factor analyses of responses of the 427 high and 415 low achievers. The two factor solution accounted for 17.7% of the variance among responses of the high achievers and 14.9% of the variance among responses of the low achievers. Overall, the factor analyses of the subgroups were similar to the factor analyses of the Total Data Analysis Sample.

Discriminant Analyses

A discriminant analysis was used to examine whether student responses to the 20 Metacognitive statements would discriminate among four groups: high achieving boys, low achieving boys, high achieving girls and low achieving girls. In these analyses high achievers were defined as students who fell within the top 30% of the sample on the MAT national percentiles. There were 206, 182, 220, and 233

students within each of the four groups, respectively.

Two discriminant functions accurately classified 44% of the students in the four groups ($X^2(69) = 343.98$, $p < .0001$). After removal of the first function, the second function further discriminated the groups ($X^2(44) = 101.82$, $p < .0001$). The means of the groups on the first discriminant function revealed that it separated high and low achievers. The second function discriminated between boys and girls. To interpret the discriminant function the correlations between the Metacognitive statements and the discriminant functions were examined. Correlations greater than .30 were considered meaningful and used to characterize the functions.

The first function indicated that low achievers: did not draw a picture (-.68); felt confused (.49); thought of a different way to solve the problem (.40); had to stop and rethink a step already done (.34); put the problem into their own words (.34); guessed and checked (.33); picked out the operations needed to work the problem (.31); and tried to remember if they had worked a problem like this before (.30).

The second function discriminated between boys and girls. Girls more often than boys reported that: they went back and checked their work (.56); kept looking back (.55); stopped and rethought a step (.40); and read the problem more than once (.33).

Thus, the results of this analysis suggest that the statements which most discriminate high and low achievers are those which deal with problem-solving strategies. Low achievers are confused about what strategies to use and how to use them. Checking behaviors appear to discriminate most between boys and girls, with girls reporting they are more likely to check their work.

To further investigate whether the low achievers or boys and girls are "confused," a second discriminant analysis was performed. In addition to the Metacognitive statements, an attribution construct, Unknown Control, was entered into the four group analysis. As an indicator of Unknown Control within each activity setting, responses to the three Unknown Control statements within each setting were summed. Unknown Control assesses a student's feeling of a general lack of control or awareness concerning why he or she is successful or fails. With the inclusion of the three indicators of Unknown Control (During Class, Working With Other Students and Homework), the two discriminant functions correctly classified 49% of the cases in the four groups. As expected, the three indicators of Unknown Control helped to discriminate between the high and low achievers. Low achievers perceived less of a sense of

control in all settings.

The Unknown Control construct as assessed within the Working With Other Students setting was also correlated above .30 on the second function. Boys felt less of a sense of control within the group setting than girls.

Self-Regulatory Statements

A principal axis factor analysis of all the Self-Regulatory statements, combined across settings, was performed. That is, statements in the During Class, Working With Other Students and Homework settings were analyzed as one set. Eigenvalues greater than 1 and a scree test were used as a criterion to determine the number of factors to retain. The three factor solution, based upon an orthogonal rotation, provided the most interpretable results. The results indicated that statements dealing with Self-Regulation while Working With Other Students are a distinct dimension from the During Class and Homework statements. The latter two settings are not as clearly discriminated from one another, but do not form one factor or dimension.

Since this overall factor analysis indicated that the types of self-regulatory behaviors exhibited within the three settings are somewhat distinct, responses from each setting were examined separately. Separate principal factor analyses were performed to help investigate the underlying structure of the responses to the statements within individual settings. The three analyses are discussed below.

Factor analysis - During Class

The 19 statements assessing self-regulatory behaviors During Class were subjected to a principal axis factor analysis. Based upon a scree test and examination of the eigenvalues greater than 1, the three factor solution was retained. The three factor solution accounted for approximately 32.2% of the common factor variance. To help interpret the three factors, the solution was orthogonally rotated and the factor loadings examined. Table 4-17 presents the statements and factor loadings. Factor loadings greater than .30 were accepted as meaningful and used to represent the factors. The three factors may be characterized as follows:

> Awareness of self-responsibility for learning: The 11 statements with loadings on this first factor address what a student actively does During Class to help learn. The statements focus upon activities which the student engages in by her or himself. For example, "I review the word problems my teacher did," and "I make

TABLE 4-17

Factor Loadings for the Self-Regulatory Statements in the During Class Activity Setting

(N=1628)

Self-Regulatory Statements	Factor Loadings		
	I	II	III
1. I get ready to listen carefully.	**.634**	.012	.060
16. I try to figure out of I need to do more to learn the lesson.	**.628**	.126	.110
15. I ask myself if I understand the lesson.	**.625**	.171	.094
18. I review the word problems my teacher did.	**.614**	.061	.160
3. I make sure I am paying attention.	**.580**	.052	.095
19. When I review word problems from class, I evaluate if I understood the lesson.	**.565**	.174	.191
17. I decide if I need to ask the teacher a question about the lesson.	**.533**	.131	**.409**
7. I think about what is important to learn in the lesson.	**.526**	.122	.027
2. I make sure I have all the materials I need.	**.462**	.095	.063
10. I think about whether I understand an example the teacher puts on the board.	**.349**	.218	.191
9. I think of an answer to a question the teacher is asking.	**.313**	.274	.142

TABLE 4-17 (continued)

5. I know when the teacher is beginning a new math idea.	.013	**.612**	.108
6. I know when the teacher is giving me practice in new math problems.	.121	**.550**	.062
4. I know when the teacher is reviewing materials already taught.	.016	**.476**	.075
14. I know when the teacher is about to end the lesson or topic.	.142	.373	.085
8. I know what the teacher is going to do next in the lesson.	.177	**.344**	.094
12. I ask my teacher to explain a problem again that I do not understand.	.251	.026	**.653**
11. When my teacher makes a mistake,I say something about the error.	.065	.163	**.500**
13. When I can think of another way to solve a word problem, I volunteer to show the class.	.092	.196	.498

Bold type indicates loadings above .30
Percentage of variance accounted for: 32.2%

sure I am paying attention." Statements from each of the three categories, before, during and after loaded on this factor.

Awareness of teacher's lesson structure: The second factor included five statements with loadings above .30. These statements assess student awareness of the teacher's structure during a mathematics lesson. Statements with meaningful loadings on this factor include, "I know when the teacher is giving me practice in new math problems," and, "I know when the teacher is about to end the lesson or topic."

Active participation in classroom activities: The final

factor includes four statements with loadings above .30. These address the students' active participation in classroom lessons. The four include statements which indicate that the student interacts with the teacher and is willing to participate in front of other students. Examples of statements are, "When my math teacher makes a mistake I say something about the error," and "I ask my teacher to explain a problem again that I do not understand."

In order to assess the internal consistency of students' responses to statements with loadings above .30 on each factor, alpha reliability coefficients were computed. All statements with loadings above .30 were included within each analysis. The obtained values were .84, .60, and .65 respectively for the three factors.

Factor Analysis - Working With Other Students

The twenty-three Self-Regulatory statements written for the Working With Other Students setting were subjected to a principal axis factor analysis. A scree test and examination of the eigenvalues indicated that the three factor solution, accounting for 43.2% of the variance, could be used to represent the data. The three factor solution was orthogonally rotated and the factor loadings above .30 examined to characterize the factors. Table 4-18 displays the statements and factor loadings. The three factors can be described as follows:

Active engagement in the group during problem-solving: The first factor includes 14 of the 23 items. The factor has statements focused on the student's interactions with others in the group about doing the word problem. Statements with high loadings are, "I say to the other students what information we need to use to work the problem," and "I talk to the other students about how other problems are like the one we are working on."

Individual monitoring and checking directed toward problem-solving: The second factor includes 12 statements with loadings above .30. They assess activities students engage in individually to make the group work and to solve the problem, with the focus on monitoring and checking activities. These are activities independent of the group activities, focused upon solving the problem. Examples are, "I look over all the work we did to see if we used the right procedures," and "I check to see if our calculations are right."

TABLE 4-18

Factor Loadings for Self-Regulatory Statements in the Working With Other Students Activity Setting (N=1538)

Self-Regulatory Statements	Factor Loadings		
	I	II	III
6. I say to the other students what I think we should do first.	**.730**	.197	.130
7. I say to the other students what information we need to use to work the problem.	**.728**	.232	.156
4. I say to the other students what I think the problem is asking.	**.656**	.239	.169
8. I say to the other students if I think something should be worked differently.	**.622**	.229	.201
5. I say to the other students how the problem is like other problems I have worked.	**.616**	.177	.093
9. I talk to the other students about how other problems are like the one we are working on.	**.596**	.248	.098
11. I explain to the other students why I think my answer or procedure is right.	**.565**	.278	.171
20. I say to the other students whether I think the answer makes sense.	**.515**	**.444**	.150
12. I encourage the other students to work on the problem too.	**.504**	**.460**	.092
10. I ask the other students questions about the problem.	**.418**	**.302**	.038
3. I think about how long it will take us so we can plan our time.	**.366**	.199	.149

TABLE 4-18 (continued)

17. I look over all the work we did to see if we used the right procedures.	.254	**.653**	.209
18. I check to see of our calculations are right.	.217	**.626**	.242
13. I listen carefully to what everyone says about the problem.	.238	**.595**	.204
16. We check each other's ideas.	**.367**	**.570**	.106
14. I keep looking back at the problem to make certain we are doing what we need to do.	.204	**.552**	.271
19. I ask the other students whether anyone thinks the answer is wrong.	**.472**	**.519**	.085
15. I keep track of what everyone says.	.190	**.494**	.164
21. I ask the other students if anyone has a different way to solve the problem.	**.479**	**.486**	.113
1. I make sure I have all the materials I will need.	.197	**.365**	.151
23. I know if I will be able to solve word problems like this.	.119	.188	**.700**
22. I know if I learned ways to do the word problem.	.134	.225	**.668**
2. I try to work the problem by myself first.	.166	.186	**.303**

Bold type indicates loadings above .30
Percentage of variance accounted for: 43.2%

<u>Self-monitoring of understanding or self-evaluation</u>: The final factor includes 3 statements which assess what a student feels he or she understands from the experiences of working the problem in the group setting. It includes monitoring aspects of self-

evaluation. For example, "I know if I learned ways to do the word problem," and "I know if I will be able to solve a word problem like this."

In order to help assess the strength of the association among statements within each factor, the internal consistency was estimated using coefficient alpha. The estimates were .91, .88 and .62 for the three factors, respectively.

Factor Analysis - Homework

The Homework setting included nine statements written to assess self-regulatory behaviors. Student responses to these nine statements were subjected to a principal axis factor analysis. The three factor solution, which accounted for approximately 41.2% of the variance, was rotated orthogonally. The factor analysis of the Homework statements revealed a factor structure which resembled the structure used to write the statements, that is, planning, monitoring and checking. Table 4-19 displays the statements and factor loadings.

Monitoring progress: The four statements with factor loadings above .30 on factor one include statements concerning a student's monitoring of her or his progress during working homework problems. An example is, "I keep track of my work as I am doing a homework word problem."

Self-responsibility and checking: Four statements loaded above .30 on the second factor. These statements include activities related to a student's self-responsibility for reviewing the homework, both alone and in preparation for school. An example is, "If I cannot do the word problems, I write out all the steps I can do and bring them to class."

Time management and planning: The two statements with loading above .30 on factor three are statements which focus upon the student's time management and preparation before doing the homework. The two items are "I decide when is the best time to do my math homework word problems," and "I decide how much time to spend on my math homework word problems."

The internal consistency of responses to statements with loadings above .30 on each of the three factors was estimated using coefficient alpha. The estimates were .74, .63 and .57 for the three factors, respectively.

TABLE 4-19

Factor Loadings for the Self-Regulatory Statements in the Homework Activity Setting

(N=1679)

Self-Regulatory Statements	Factor Loadings		
	I	II	III
4. I read each problem carefully.	**.763**	.172	.058
5. I keep track of my work as I am doing a homework word problem.	**.697**	.208	.085
6. I make sure I try every problem, even if I cannot solve them all.	**.536**	.265	.019
3. I make sure I have all the materials I need.	**.424**	**.314**	.222
7. If I cannot do the word problems, I write out all the steps I can do and bring them to class.	.175	**.655**	.049
9. I review my homework word problems before class.	.188	**.493**	.198
8. If I do not understand the homework word problems, I ask the teacher to explain them.	.293	**.432**	-.030
2. I decide how much time to spend on my math homework word problems.	-.018	.100	**.637**
1. I decide when is the best time to do my math homework word problems.	.135	.033	**.622**

Bold type indicates loadings above .30
Percentage of variance accounted for: 41.2%

Affective Beliefs, Motivations and Attributions

Means and Standard Deviations

The means and standard deviations of items summed for each psychological construct within each setting were examined. Prior to summing, the scoring on negatively worded items was reversed. The summed scores are displayed in Tables 4-20 through 4-22 for the During Class, Working With Other Students, and Homework settings, respectively.

The summed scores can range from 3 to 15 for all clusters with the exception of the two-item cluster for Internal Learning Goals in the Homework activity setting. To compare means for the Internal Learning Goals in all settings, the mean for Homework was estimated using the information from the two item cluster. Responses to the two items were averaged, and then this average multiplied by three.

As displayed in Tables 4-20 through to 4-22 lower scores indicate more of the construct. For example, in Table 4-20, During Class, the lower mean for Confidence (6.86) indicates more confidence and the higher mean for anxiety (10.14) indicates less anxiety, on the average.

Differences Across Settings

Table 4-23 presents the means, standard deviations, and results of the repeated measures multivariate analysis of variance. This analysis permits examination of differences in means for each construct across the three settings. These means differ from those reported in Tables 4-20 to 4-22 since only students with complete responses across all three activity settings could be included in Table 4-23.

As inspection of the means indicates, the differences are small but significant, given the large sample size. Table 4-23 also includes a summary of the differences among the three means, as defined by the confidence intervals for the means. For example, for Value, the mean in the setting of Working With Other Students is significantly different from the mean responses for During Class and Homework, but the latter two means are not different. For Interest, all three means are significantly different. Since the variables are coded so that a higher number indicates LESS of an interest, students are indicating the greatest interest in working on solving mathematical word problems in the group setting, then in class, then in homework. For the group setting, items are, "I think it would be interesting to work on a math word problem with other students," "I would find math interesting if I worked on a word problem

TABLE 4-20

Mean, Standard Deviation, Variance, Skewness, and Range of Summed Psychological Construct Scores in the During Class Activity Setting

Psychological Construct	Mean	SD	Variance	Skewness	Range	N
Value	7.37	2.61	6.80	.40	3-15	1686
Interest	8.49	2.63	6.89	.20	3-15	1688
Confidence	6.86	2.46	6.03	.42	3-15	1688
Anxiety	10.14	3.03	9.20	-.39	3-15	1683
Internal Learning Goals	7.67	2.79	7.81	.22	3-15	1705
External Performance Goals	8.78	2.27	5.13	.05	3-15	1656
Internal Stable Controllable	7.14	2.46	6.07	.41	3-15	1693
Internal Stable Uncontrollable	7.99	2.62	6.88	.17	3-15	1674
External Stable Uncontrollable	9.86	2.59	6.72	-.22	3-15	1678
Unknown Control	11.65	2.84	8.04	-.69	3-15	1654

TABLE 4-21

Mean, Standard Deviation, Variance, Skewness, and Range of Summed Psychological Construct Scores in the Working With Other Students Activity Setting

Psychological Construct	Mean	SD	Variance	Skewness	Range	N
Value	8.19	2.39	5.71	.09	3-15	1666
Interest	7.82	2.61	6.79	.30	3-15	1661
Confidence	6.87	2.28	5.20	.40	3-15	1673
Anxiety	10.99	2.62	6.87	-.53	3-15	1667
Internal Learning Goals	7.50	2.81	7.87	.50	3-15	1665
External Performance Goals	10.83	2.73	7.44	-.34	3-15	1674
Internal Stable Controllable	9.63	2.88	8.27	-.14	3-15	1659
Internal Stable Uncontrollable	8.52	2.65	7.04	.19	3-15	1636
External Stable Uncontrollable	10.61	2.60	6.78	-.25	3-15	1676
Unknown Control	11.16	2.68	7.17	-.57	3-15	1634

TABLE 4-22

Mean, Standard Deviation, Variance, Skewness, and Range of Summed Psychological Construct Scores in the Homework Activity Setting

Psychological Construct	Mean	SD	Variance	Skewness	Range	N
Value	7.40	2.67	7.11	.31	3-15	1671
Interest	9.60	3.09	9.56	-.06	3-15	1690
Confidence	6.46	2.59	6.68	.59	3-15	1695
Anxiety	10.70	2.61	6.82	-.37	3-15	1689
Internal Learning Goals	8.56	3.44	11.80	.15	3-15	1700
External Performance Goals	8.64	2.95	8.72	.16	3-15	1675
Internal Stable Controllable	7.34	2.43	5.88	.25	3-15	1668
Internal Stable Uncontrollable	12.17	2.74	7.51	-1.03	3-15	1697
External Stable Uncontrollable	10.45	2.66	7.09	-.37	3-15	1674
Unknown Control	11.04	2.77	7.69	-.50	3-15	1680

TABLE 4-23

Means, Standard Deviations and Differences for the Summed Psychological Constructs as Indicated by Repeated Measures Analyses Across Activity Settings

Psychological Construct	Activity Setting: During Class M	SD	Working With Others M	SD	Homework M	SD	Sig[a]
Value	7.39	2.60	8.18	2.40	7.36	2.66	D,H<WO
Interest	8.48	2.64	7.82	2.62	9.57	3.08	WO<D<H
Confidence	6.84	2.45	6.84	2.28	6.47	2.59	H<D,WO
Anxiety	10.13	3.04	11.00	2.61	10.70	2.62	D<H<WO
Internal Learning Goals	7.66	2.80	7.49	2.81	8.52	3.42	WO,D<H
External Performance Goals	8.78	2.26	10.84	2.73	8.65	2.95	D,H<WO
Internal Stable Controllable	7.12	2.47	9.64	2.87	7.33	2.42	D,H<WO
Internal Stable Uncontrollable	8.00	2.60	8.50	2.64	12.15	2.74	D<WO<H
External Stable Uncontrollable	9.85	2.59	10.62	2.60	10.44	2.66	D<WO,H
Unknown Control	11.66	2.84	11.17	2.67	11.06	2.75	WO,H<D

[a] Statistically significant differences Wilks Lambda $p<.0001$
D - During Class; WO - With Others; H - Homework
Arrows indicate direction of differences, commas indicate no difference $N=1600$

with a group of students," and "Word problems would not be interesting to me if I did them with a group of students."

Overall, the results of the repeated measures analyses show that the means for three constructs differ for each of the three settings: Interest, Anxiety, and the attribution, Internal Stable Controllable. The means of the remaining seven constructs differ in at least one setting from the other two settings. For individuals, as the repeated measures analysis indicates, settings do make a difference in responses to this set of affective beliefs, motivations and attributions. The data have also been analyzed using a 3-way multidimensional scaling procedure (SINDSCAL) and yield the same conclusion: the salience of student's reported affective beliefs, attributions and motivations varies as a function of classroom-related activity settings (Tittle, Weinberg, & Hecht, 1990).

Pearson Correlations

Pearson correlations among the ten constructs within each setting were examined. These are presented in Table 4-24. The pattern of correlations greater than .30 within each setting differed. Within all three settings, the most consistent correlation was the negative relationship between Anxiety and Confidence.

One attribution, Internal Stable Uncontrollable, was positively related to Confidence in the During Class setting (r=.35) and the Working With Other Students settings (r=.38), but negatively correlated within the Homework setting (r=-.59). The construct includes the belief that success or failure is due to "uncontrollable" factors, such as ability or mathematical aptitude. Examination of the statements suggests that they may be interpreted differently within each setting. In the During Class setting and Working With Other Students setting, the Internal Stable Uncontrollable statements focus upon attributions for successful problem-solving. For example, "If I can follow my teacher's explanation for word problems, it is because I am smart," (During Class) and "If I solve a word problem with other students, it is because we have enough ability" (Working With Other Students). In contrast the Internal Stable Uncontrollable statements within the Homework setting focus upon attributions for failure. For example, "If I cannot do math homework word problem, it is because I am not smart enough." This finding implies that students are responding to the "ability" component of the construct, rather than the "attribution" component.

On the other hand, the correlations between the Internal Stable Uncontrollable construct and the External Stable Uncontrollable construct within each setting were positive (During Class .16, Working With Other Students .24,

TABLE 4-24

Pearson Correlations Among the Summed Psychological Constructs[1] and With Achievement Scores Within Settings

During Class (N's range from 1619 to 1672)

	VAL	INT	CON	ANX	ILG	EPG	ISC	ISU	ESU	UK
VAL	1.00									
INT	**.36**	1.00								
CON	.26	**.30**	1.00							
ANX	-.20	-.25	**-.51**	1.00						
ILG	**.47**	**.40**	.19	-.19	1.00					
EPG	-.04	.05	.05	.01	.14	1.00				
ISC	**.41**	**.32**	.21	-.12	**.55**	.19	1.00			
ISU	.20	.24	**.35**	-.25	.28	.24	**.32**	1.00		
ESU	.07	.06	-.20	.16	.15	.18	.20	.16	1.00	
UK	-.22	-.24	**-.56**	**.47**	-.11	.10	-.10	-.18	**.33**	1.00
MATSS	.07	-.05	-.29	.19	.10	-.02	.10	-.16	.23	.28
MATNP	.03	-.06	-.29	.19	.07	.01	.06	-.17	.20	.28
DRPSS	.12	.06	-.19	.10	.14	.01	.14	-.02	.23	.23
DRPNP	.05	.03	-.23	.12	.10	.05	.11	-.05	.21	.27

Working With Other Students (N's range from 1585 to 1634)

	VAL	INT	CON	ANX	ILG	EPG	ISC	ISU	ESU	UK
VAL	1.00									
INT	**.55**	1.00								
CON	**.37**	**.37**	1.00							
ANX	**-.33**	**-.45**	**-.51**	1.00						
ILG	**.58**	**.57**	**.42**	**-.34**	1.00					
EPG	-.17	-.24	-.19	**.41**	-.14	1.00				
ISC	.07	.08	.01	.14	.11	**.30**	1.00			
ISU	**.34**	.26	**.38**	-.12	**.41**	.12	.20	1.00		
ESU	.04	.06	-.06	.19	.09	**.42**	**.35**	.24	1.00	
UK	-.07	-.07	-.23	**.34**	-.03	**.46**	**.38**	.08	**.49**	1.00
MATSS	.08	.07	-.18	.14	.00	.13	.07	-.03	.10	.23
MATNP	.04	.06	-.15	.11	.00	.13	.08	-.05	.12	.23
DRPSS	.07	.05	-.16	.15	.02	.13	.10	.00	.14	.25
DRPNP	.04	.03	-.14	.13	.01	.15	.10	-.02	.17	.25

TABLE 4-24 (continued)

Doing Homework (N's range from 1615 to 1665)

	VAL	INT	CON	ANX	ILG	EPG	ISC	ISU	ESU	UK
VAL	1.00									
INT	**.47**	1.00								
CON	**.36**	.27	1.00							
ANX	-.16	-.22	**-.45**	1.00						
ILG	**.36**	**.63**	**.30**	-.28	1.00					
EPG	**-.32**	**-.32**	-.16	.00	-.17	1.00				
ISC	**.37**	**.42**	.29	-.25	**.47**	-.05	1.00			
ISU	**-.31**	-.06	**-.59**	**.32**	-.06	.16	-.15	1.00		
ESU	-.26	-.14	**-.50**	**.32**	-.11	.25	-.06	**.56**	1.00	
UK	-.29	-.06	**-.50**	**.29**	-.03	.24	-.11	**.61**	**.55**	1.00
MATSS	.02	.06	-.20	.21	-.01	-.10	.09	.23	.17	.21
MATNP	-.01	.04	-.21	.18	-.02	-.07	.04	.25	.20	.23
DRPSS	.00	.13	-.17	.13	.08	-.05	.07	.21	.14	.22
DRPNP	-.02	.08	-.22	.14	.04	-.02	.07	.24	.18	.23

Note: N'S Vary due to missing data being deleted pairwise)

[1] Psychological constructs and achievement scores are indicated as:

VAL	Value
INT	Interest
CON	Confidence
ANX	Anxiety
ILG	Internal Learning Goals
EPG	External Performance Goals
ISC	Internal Stable Controllable
ISU	Internal Stable Uncontrollable
ESU	External Stable Uncontrollable
UK	Unknown Control
MATSS	Mathematics Achievement Test - Scaled Score
MATNP	Mathematics Achievement Test - National Percentile
DRPSS	Degrees of Reading Power - Scaled Score
DRPNP	Degrees of Reading Power - National Percentile

and Homework .56). This pattern suggests that students also respond to the "attribution" component of the statements.

Examination of the correlations of the mathematics and reading achievement level (both scaled scores and national percentiles) with each construct revealed that no correlation exceeded .30. The largest correlations were between Confidence During Class and MAT scaled score (-.29) and MAT national percentile (-.29). This indicates greater confidence is associated with higher achievement scores. The correlations between the Unknown Control construct and the achievement scores were at least .20, indicating that students who tend to endorse these statements (lower scores indicate more of the construct, i.e., less of a sense of control over success or failure) are those who tend to do less well on these tests. The low correlations for the constructs and achievement measures also indicates the independence of the achievement and MAQ constructs.

Discriminant Analyses

A discriminant analysis was used to examine whether student responses to the summed psychological constructs would discriminate among four groups: high achieving boys, low achieving boys, high achieving girls and low achieving girls. In these analyses high achievers were defined as students who fell within the top 30% of the sample on the MAT national percentiles. Separate analyses were performed for each of the three activity settings.

In the During Class setting there were 156 low achieving boys, 207 low achieving girls, 181 high achieving boys, and 207 high achieving girls. Two discriminant functions accurately classified 45% of the students in the four groups ($X^2(30) = 239.82$ $p < .0001$). After removal of the first function, the second function further discriminated the groups ($X^2(18) = 58.80$, $p < .0001$). The first eigenvalue was .279 and the second .073. The first discriminant function most separated high and low achievers and the second function most discriminated between boys and girls. To interpret the discriminant functions the correlations greater than .30 between the statements and the discriminant functions were examined.

Correlations with the first function indicated that low achievers were less Confident (.75), had less of a sense of control (-.63), did not attribute success to Internal Stable Uncontrollable causes (.49), were more Anxious (-.42) and more likely to attribute success to External Stable Uncontrollable causes (-.34). The second function discriminated between boys and girls. Boys more often attributed success to External Stable Uncontrollable causes (.68) and Internal Stable Uncontrollable causes (.54),

reported more External Performance Goals (.60) and had less of a sense of control (Unknown Control) over their successes or failures (.31) than girls.

In the Working With Other Students setting there were 161 low achieving boys, 192 low achieving girls, 179 high achieving boys, and 198 high achieving girls. Two discriminant functions accurately classified 41% of the students ($X^2(30) = 169.54$, $p < .0001$). After removal of the first function, the second function further discriminated the groups ($X^2(18) = 59.83$, $p < .0001$). The first two eigenvalues were .164 and .068. The first function discriminated between the high and low achievers. Low achievers tend to have less of a sense of control, Unknown Control (.88), to be motivated by External Performance Goals (.64), to attribute failure to External Stable Uncontrollable causes (.50), to be more Anxious (.49), to have less Confidence (-.42), and to attribute failure to Internal Stable Controllable causes (.41). The second function discriminated between boys and girls. Boys more often attributed success to Internal Stable Uncontrollable causes (.59), reported less Interest in working word problems in a group (-.47), reported greater Confidence (.43) and more External Performance Goals (.38).

In the Homework setting there were 187 high achieving boys, 150 low achieving girls, 199 high achieving boys, and 213 high achieving girls. Two discriminant functions accurately classified 41% of the students ($X^2(30) = 177.86$, $p < .0001$). After removal of the first function, the second function further discriminated the groups ($X^2(18) = 52.52$, $p < .0001$). The first function discriminated between the high and low achievers. Low achievers tended to have less Confidence (-.63), to attribute failure to Internal Stable Uncontrollable causes (.57), to be more Anxious (.57), to attribute failure to External Stable Uncontrollable causes (.56), to have less of a sense of control (.55), and to not be motivated by External Performance Goals (-.31). Boys reported less of a sense of control (.62), more often attributed failure to Internal Stable Uncontrollable causes (.53), reported less Value for homework word problems (-.47), were more often motivated by both Internal Learning Goals and External Performance Goals (.38).

CHAPTER V

REPORTS FOR MEANING AND USE

The statements of the Mathematics Assessment Questionnaire have been written to provide information for classroom instructional planning. Two approaches to examining student responses are recommended for the MAQ. One approach is to use the item level responses for an individual or for a group. This can be used with all the MAQ statements. It is the only approach used for the Metacognitive and Self-Regulatory statements, in the area of "Directed Cognition." Another approach can be used with the 3-item clusters of the affective, motivational and attributional constructs, in the area of "Intentionality." This second approach is the use of CRT-type indicators.

Directed Cognition: Use of Statement-Level Responses

The approach taken to examining student responses in the Metacognitive and Self-Regulatory categories is at the individual statement level. These statements have NOT been summed for a total "Metacognitive", or "Self-Regulatory" score because of the characteristics of the statements and of the characteristics of student responses to the statements. For both sections the statements have been organized or grouped into logical units of before, during, and after a activity. The activities are solving an individual problem, or learning about and solving word problems in the settings of During Class, Working With Other Students, or Homework. The reasons for examining only responses to individual statements are as follows:

- Although the before, during, and after units are logical, in the actual problem-solving processes students work back and forth among the thinking activities. This has been described for the metacognitive activities in a group problem-solving setting (Artzt and Armour-Thomas, 1990) and for individual problem solvers (Schoenfeld, 1985).

- For the Metacognitive statements, some activities are more likely to be used or are more appropriate for some problems than for others. Teacher ratings of the appropriateness of the statements for the coin problem, for example, will vary.

- The use of the statements or prompts in these sections results in obtaining student reflections about these processes, rather than obtaining more direct observation of students at work or thinking aloud during the problem-solving process.

The statements thus impose a particular structure on

student responses, and it is not justifiable to summarize the responses for any of the sections to obtain a total score for a student or a mean score for a class. This conclusion is supported by statistical analyses of the statements and student responses, which indicate that there is not a single factor or dimension underlying the groups of statements for Metacognitive and Self-Regulatory statements (see Chapter IV).

In summary, the approach to using student responses to the MAQ for the Metacognitive and Self-Regulatory statements is on an individual statement basis. Examples of individual and class responses as well as uses for the responses are given in Chapter IV of the Manual for Users. The remaining items in the MAQ can also be examined on an individual statement basis. However, a different CRT-type of score has been developed for them.

Intentionality: Use of CRT-Type Scores

Criterion or objective referenced scores have been useful in achievement testing. Such scores typically have more direct meaning for instructional planning:

1. they are referenced to smaller units of statements or questions, typically from 3-6; and

2. a standard or cutoff score is set indicating mastery or non-mastery in the achievement test context, where "non-mastery" indicates a need for further classroom instruction.

In the context of the MAQ a similar strategy has been developed for the 3-item clusters of the affective beliefs, motivations and attributions in each setting. Criterion-referenced test-like scores were created for individual students on each of the 3-statement clusters. These scores indicate if students have 0, 1, 2, or 3 responses to the three statements in a cluster in a manner indicating the need for follow-up instructional planning by the teacher. The CRT-type score has direct meaning, as opposed to the use of summed scores on the five point rating scales. Summed scores on the five point rating scale can range from 3 to 15, and students can have different response patterns for the same score.

The use of the need criteria provides a direct interpretation for use in instructional planning in the following manner. A student is identified as having "need" for follow-up by the teacher when the student responds to at least 2 of the 3 statements in a cluster so as to indicate a need. On any single item, the student has to select one of the two most extreme response options to indicate need. For the affective beliefs, low Value, low Interest, low Confidence and high Anxiety are indicators of need. For the

Motivations, being motivated by External Performance Goals and not motivated by Internal Learning Goals are indicators of need. For the attributions, one indicator of need is success or failure which is not attributed to causes which are Internal Stable Controllable. Other indicators for need for the attributions include success or failure attributed to causes which are External Stable Uncontrollable, Internal Stable Uncontrollable, or a feeling of Unknown Control. A list of item numbers for each category and the direction in which they are counted to determine if they meet the criteria of need are presented in Appendix 5-1.

The statistical procedures for creating these CRT-type scores for a 3-item cluster are as follows:

1) Responses to each item are dichotomized: If students select either of the two extreme response options which indicate need in that area, they receive a "1," otherwise a "0."

2) The number of 1's is summed across the three statement cluster.

3) If this sum equals 2 or 3, students are identified as in need of attention in that area.

An example of how a CRT-type score is computed follows for the construct of Anxiety in the Homework setting.

Suppose a student responds to the three Anxiety items:

ANXIETY:

	VERY TRUE	TRUE	SORT OF TRUE	NOT VERY TRUE	NOT AT ALL TRUE
19. I feel nervous when I think about doing hard word problems for homework.	*				
26. I feel relaxed when I am doing math word problems at home.					*
36. Doing word problems for homework does not make me nervous.			*		

The student's responses are then recoded:

item 19 - student reports feeling anxious as indicated by a response in one of the two extreme categories. (a VERY TRUE response); - the student receives a "1" for this response

item 26 - the student reports feeling anxious as reported in one of the two extreme categories. (a NOT AT ALL TRUE response) - student receives a "1" for this response

item 23 - the student does not report feeling anxious as indicated by marking one of the two extreme categories. (a TRUE response) - student receives a "0" for this response. To receive a "1" the student would have had to respond NOT VERY TRUE or NOT AT ALL TRUE.

The "1's" are summed. The total of 2 falls within the cutoff (two or three responses indicating need). Therefore this student is identified for follow-up work by the teacher to determine whether instructional activities are needed in this area.

An Alternative CRT-approach.

An alternative CRT-scoring scheme was also examined. Rather than identifying the two most extreme responses (VERY TRUE and TRUE or NOT VERY TRUE and NOT AT ALL TRUE, depending upon the statement) the three most extreme categories were considered as indicative of "need." Thus, unlike the previous procedure, the SORT OF TRUE category was considered as indicating need.

This alternative scoring system, and the original CRT type scoring were compared on two features:

1. Internal consistency, as estimated by coefficient alpha; and
2. The number of students identified as in need for follow-up work using both CRT approaches.

Alpha reliability coefficients were computed based upon the CRT-coding. That is, the coefficients were based upon the dichotomized 0 or 1 scores. These results were compared with the coefficients based upon the raw data (summing of original ratings). The three sets of coefficient alpha reliabilities are presented in Table 5-1. In Table 5-1 Alpha 1 is the reliability based on the raw, summed scores. Alpha 2 is the CRT indicator using the two extreme categories to form the dichotomy. Alpha 3 is the CRT indicator using the two extreme rating categories plus the middle rating category to form the dichotomy.

TABLE 5-1

Coefficient Alpha Reliabilities of Responses to Three Item Clusters of Affective Beliefs, Motivations and Attributions Based on Summed Scores (Alpha1), CRT Version 1 (Alpha2), and CRT Version 2 (Alpha3)

Psychological Construct	Activity Setting: During Class	Working with Other Students	Homework
Value[a]			
Items	(26) 28 34	32 44 (46)	(12) 20 (39)[b]
Alpha1	.500	.394	.483
Alpha2	.374	.338	.320
Alpha3	.431	.287	.425
Interest			
Items	24 (44) 49	30 36 (40)	18 (34) 28
Alpha1	.335	.487	.725
Alpha2	.273	.412	.659
Alpha3	.247	.442	.619
Confidence			
Items	20 (31) (48)	24 (27) 48	(13) 22 (35)
Alpha1	.548	.412	.611
Alpha2	.303	.249	.413
Alpha3	.302	.382	.522
Anxiety			
Items	(27) 35 (39)	(25) 31 (51)	(19) 26 36
Alpha1	.576	.520	.451
Alpha2	.484	.414	.339
Alpha3	.490	.429	.425
Internal Learning Goals			
Items	30 32 43	29 33 39	15 31 23
Alpha1	.710	.698	.386
Alpha2	.449	.596	.369
Alpha3	.632	.637	.422

TABLE 5-1 (continued)

Psychological Construct	Activity Setting: During Class	Working With Other Students	Homework
External Performance Goals			
Items	25 36 40	37 43 53	14 33 29
Alpha1	.203	.532	.543
Alpha2	.193	.469	.471
Alpha3	.142	.475	.502
Internal Stable Controllable			
Items	3 45 47	34 41 49	17 25 37
Alpha1	.620	.610	.605
Alpha2	.525	.572	.505
Alpha3	.523	.541	.541
Internal Stable Uncontrollable			
Items	22 37 41	26 38 52	10 16 38
Alpha1	.592	.621	.730
Alpha2	.515	.556	.639
Alpha3	.472	.545	.682
External Stable Uncontrollable			
Items	23 29 46	35 50 45	21 32 27
Alpha1	.418	.613	.603
Alpha2	.358	.476	.512
Alpha3	.356	.554	.516
Unknown Control			
Items	21 33 38	28 42 47	11 30 24
Alpha1	.683	.588	.661
Alpha2	.524	.466	.567
Alpha3	.632	.544	.592

[a] Alpha1= raw scores. Alpha2= CRT Version 1 (2 extreme response categories). Alpha3= CRT Version 2 (3 extreme response categories).
[b] Coding of items in parentheses is reversed.

As might be expected, the coefficients based upon the dichotomized scores typically were lower than the coefficients based upon the raw scores. The difference in the alphas between the CRT (with 2 extreme categories) and the summed raw scores alpha ranged from .01 to .27, with a median difference of .10. However, large, consistent differences in the alpha reliability coefficients were not found between the two CRT approaches. The differences between the two CRT sets of alphas ranged from .00 to .19 with 20 of the 30 alphas having differences of .05 or less, six of .06-.10, and two of .11, one of .14 and one of .19.

The number of students out of 1737 who would be identified as needing follow-up work were compared based upon both CRT scoring systems. The results are presented for constructs in each of the three settings in Tables 5-2, 5-3 and 5-4. The tables present the number of students for teacher follow-up based on two of the three statements in a cluster, three of the three statements in a cluster, and the total of both (i.e., 2 or 3 statements).

The first scoring system, version 1, included the items which had been dichotomized so two extreme responses indicated need. Using this version between 7% (N=115) and 44% (N=763) of the students were identified for teacher follow-up. The alternative scoring system, called version 2, identified between 22% (N=384) and 76% (N=1327) of the students as needing instructional follow-up. In version 2 items were dichotomized so that the two extreme responses plus the middle category indicated need. Based on the modest alpha reliabilities of both CRT-type scores, the more conservative approach, that is, identifying smaller numbers of students, is most appropriate. Since there were not consistent or large differences between the reliability coefficients based upon the two coding procedures, the first, more conservative CRT-coding procedures has been adopted.

TABLE 5-2

During Class Activity Setting:
Numbers of Students Identified as Needing Follow-up
Classroom Activities Using Alternative Scoring Procedures
Based Upon Responses to at Least 2 of 3 Statements

Psychological Construct	VERSION ONE Number of statements indicating need			VERSION TWO Number of statements indicating need		
	2/3	3/3	Total	2/3	3/3	Total
Value	166	50	216	460	258	718
Interest	337	95	432	649	351	1000
Confidence	128	22	150	361	214	575
Anxiety	260	114	374	433	369	802
Internal Learning Goals	223	68	291	452	395	847
External Performance Goals	613	83	696	884	281	1065
Internal Stable Controllable	115	0	115	398	285	683
Internal Stable Uncontrollable	453	310	763	485	842	1327
External Stable Uncontrollable	266	83	349	519	332	851
Unknown Control	121	55	176	281	208	489

Version 1: dichotomized so 2 extreme responses versus the other 3 response categories.
Version 2: dichotomized so 2 extreme responses plus middle category versus the other 2 résponse categories.

TABLE 5-3

Working With Other Students Activity Setting:
Numbers of Students Identified as Needing Follow-up
Classroom Activities Using Alternative Scoring Procedures
Based Upon Responses to at Least 2 of 3 Statements

Psychological Construct	VERSION ONE Number of statements indicating need			VERSION TWO Number of statements indicating need		
	2/3	3/3	Total	2/3	3/3	Total
Value	373	44	417	752	240	992
Interest	228	74	302	495	293	788
Confidence	119	21	140	458	147	605
Anxiety	175	48	223	434	193	627
Internal Learning Goals	167	86	253	367	359	726
External Performance Goals	243	65	308	461	191	652
Internal Stable Controllable	423	298	721	486	738	1224
Internal Stable Uncontrollable	409	237	646	492	754	1246
External Stable Uncontrollable	189	59	248	458	291	749
Unknown Control	145	54	199	313	228	541

Version 1: dichotomized so 2 extreme responses versus the other 3 response categories.
Version 2: dichotomized so 2 extreme responses plus middle category versus the other 2 response categories.

TABLE 5-4

Homework Activity Setting:
Numbers of Students Identified as Needing Follow-up Classroom Activities Using Alternative Scoring Procedures Based Upon Responses to at Least 2 of 3 Statements

Psychological Construct	VERSION ONE Number of statements indicating need			VERSION TWO Number of statements indicating need		
	2/3	3/3	Total	2/3	3/3	Total
Value	196	44	240	481	251	732
Interest	342	314	656	442	792	1234
Confidence	115	29	144	344	167	511
Anxiety	169	53	222	417	338	655
Internal Learning Goals	355	357	712[a]	446	783	1239
External Performance Goals	449	236	685	532	632	1164
Internal Stable Controllable	138	44	182	450	314	764
Internal Stable Uncontrollable	113	53	166	235	149	384
External Stable Uncontrollable	238	71	309	517	279	796
Unknown Control	172	70	242	388	259	647

Version 1: dichotomized so 2 extreme responses versus the other 3 response categories.
Version 2: dichotomized so 2 extreme responses plus middle category versus the other 2 response categories.
[a] only two of three items were retained for analysis.

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Appendix 3-1
Source Questionnaire: Classification of Statements

NAME_____ TODAY'S DATE _____

SCHOOL_____ GRADE _____

TEACHER'S NAME_____ PERIOD_____

CIRCLE: BOY GIRL YOUR AGE _____

WHICH BEST DESCRIBES YOU: ASIAN BLACK HISPANIC WHITE OTHER

The questions in this booklet ask about what you think and feel about doing math word problems. This is not a test. YOU DO NOT HAVE TO ANSWER ANY QUESTION YOU DO NOT WANT TO. This is just a way to get your ideas about math. You will not be graded on your answers and the information will not affect your grades or school work. Please answer each question carefully. Be sure to answer BOTH sides of each page.

SOURCE QUESTIONNAIRE

Items classified as written

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PART I

First solve the problem. Use the space below to work on the problem. Then answer the statements about what you thought and did as you worked the problem.

Eight pennies are arranged in a row on a table. Every other coin is replaced with a nickel. Then, every third coin is replaced with a dime. Finally, every fourth coin is replaced with a quarter. What is the total value of the coins on the table?

Now go to the next page and say what you did.

BEFORE YOU BEGAN TO SOLVE THE PROBLEM - WHAT DID YOU DO?
Try to think of exactly what you did. Circle the answer that best describes what you think you did.

	NO No, I didn't do this	MAYBE I may have done this	YES Yes, I did do this
1. I read the problem more than once.	NO	MAYBE	YES
2. I thought to myself, Do I understand what the question is asking me?	NO	MAYBE	YES
3. I tried to put the problem into my own words.	NO	MAYBE	YES
4. I tried to remember if I had worked a problem like this before.	NO	MAYBE	YES
5. I thought about what information I needed to solve this problem.	NO	MAYBE	YES
6. I asked myself, Is there information in this problem that I don't need?	NO	MAYBE	YES
7. I wrote down important information.	NO	MAYBE	YES

AS YOU WORKED THE PROBLEM - WHAT DID YOU DO? Circle the answer that best describes what you think you did.

8. I thought about all the steps as I worked the problem.	NO	MAYBE	YES
9. I kept looking back at the problem after I did a step.	NO	MAYBE	YES
10. I had to stop and rethink a step I had already done.	NO	MAYBE	YES
11. I checked my work step-by-step as I worked the problem.	NO	MAYBE	YES

AFTER YOU FINISHED WORKING THE PROBLEM - WHAT DID YOU DO? Circle the answer that best describes what you think you did.

	NO No, I didn't do this	MAYBE I may have done this	YES Yes, I did do this
12. I looked back to see if I did the correct procedures.	NO	MAYBE	YES
13. I checked to see if my calculations were correct.	NO	MAYBE	YES
14. I went back and checked my work again.	NO	MAYBE	YES
15. I looked back at the problem to see if my answer made sense.	NO	MAYBE	YES
16. I thought about a different way to solve the problem.	NO	MAYBE	YES

DID YOU USE ANY OF THESE WAYS OF WORKING? Circle the answer that best describes what you think you did.

17. I drew a picture to help me understand the problem.	NO	MAYBE	YES
18. I "guessed and checked."	NO	MAYBE	YES
19. I picked out the operations I needed to do this problem.	NO	MAYBE	YES
20. I felt confused and could not decide what to do.	NO	MAYBE	YES

PART II

INSTRUCTIONS

WHAT HAPPENS WHEN YOU WORK WORD PROBLEMS IN VARIOUS SETTINGS -- at school, in a group, at home?

How true is each statement for you? Circle your answer: (1) if very true, (2) if true, (3) if sort of true, (4) if not very true, or (5) if not at all true.

DURING CLASS

Think about when your teacher teaches about word problems. What do you do before the lesson begins, during the lesson, and after the lesson? Try to think of exactly what you do. How true is each statement for you? Circle your answer.

1	2	3	4	5
Very True	True	Sort of True	Not Very True	Not At All True

AT THE BEGINNING OF A MATH LESSON ABOUT WORD PROBLEMS:

1.	I get ready to listen carefully.	1	self reg	5
2.	I make sure I have all the materials I need.	1	self reg	5
3.	I make sure I am paying attention.	1	self reg	5
4.	I know when the teacher is reviewing material already taught.	1	self reg	5
5.	I know when the teacher is beginning a new math idea.	1	self reg	5
6.	I know when the teacher is giving me practice in new math problems.	1	self reg	5

1 Very True	2 True	3 Sort of True	4 Not Very True	5 Not At All True

DURING A MATH LESSON ABOUT WORD PROBLEMS:

7. I think about what is important to learn in the lesson.	1	self reg	5
8. I know what the teacher is going to do next in the lesson.	1	self reg	5
9. I think of an answer to a question the teacher is asking.	1	self reg	5
10. I think about whether I understand an example the teacher puts on the board.	1	self reg	5
11. When my math teacher makes a mistake, I say something about the error.	1	self reg	5
12. I ask my math teacher to explain a problem again that I do not understand.	1	self reg	5
13. When I can think of another way to solve a word problem, I volunteer to show the class.	1	self reg	5
14. I know when the teacher is about to end the lesson or topic.	1	self reg	5

AT THE END OF A MATH LESSON ABOUT WORD PROBLEMS:

15. I ask myself if I understand the lesson.	1	self reg	5
16. I try to figure out if I need to do more to learn the lesson.	1	self reg	5
17. I decide if I need to ask the teacher a question about the lesson.	1	self reg	5
18. I review the word problems my teacher did.	1	self reg	5
19. When I review word problems from class, I evaluate if I understood the lesson.	1	self reg	5

DURING CLASS

Think about when your teacher teaches about word problems. What do you think and feel? How true is each statement for you? Circle your answer.

1 Very True	2 True	3 Sort of True	4 Not Very True	5 Not At All True

20.	I feel confident that I will be able to follow any word problem my math teacher explains in class.	1	confidence	5
21.	When I correctly answer a question my teacher asks about word problems, I usually do not know why I get it right.	1	unkn control	5
22.	If I correctly answer a question my teacher asks about word problems, it is because I have the ability to learn math.	1	ISU	5
23.	If I understand the word problems my teacher does on the board, it is because I have a good teacher.	1	ESU	5
24.	I enjoy trying to answer the math word problems my teacher asks in class.	1	interest	5
25.	I only answer questions about word problems in math class to please my teacher.	1	EPG	5
26.	Even when I listen to my teacher, I cannot understand how learning to solve word problems will help me in my everyday life.	1	value	5
27.	I am afraid when I have to ask my math teacher a question about a word problem during class.	1	anxiety	5
28.	It is important to learn to do the types of word problems my teacher explains in class.	1	value	5
29.	If I am able to solve a word problem on the board, it is because the problem was easy.	1	ESU	5

	1 Very True	2 True	3 Sort of True	4 Not Very True	5 Not At All True

DURING CLASS:

30. I volunteer to do word problems on the board so I can learn something more about math.	1	ILG		5
31. I do not expect to be able to answer the questions my math teacher asks about word problems.	1	confidence		5
32. I pay attention during my teacher's lessons on word problems because it helps me learn math.	1	ILG		5
33. I usually do not know what is going on when my teacher is explaining a word problem.	1	unkn control		5
34. Listening to my math teacher explain word problems during class helps me see how important math is.	1	value		5
35. When I am in math class, I usually feel very much at ease and relaxed.	1	anxiety		5
36. I pay attention when my teacher explains word problems if I know I will have a test on them.	1	EPG		5
37. If I can follow my teacher's explanation for word problems, it is because I am smart.	1	ISU		5
38. I do not know why I cannot follow the word problems my teacher works on the board.	1	unkn control		5
39. I get scared when I have to work a word problem on the board.	1	anxiety		5
40. I volunteer to do a word problem on the board if I think it will help my grade.	1	EPG		5
41. If I can solve a word problem the teacher puts on the board, it is because I think mathematically.	1	ISU		5

	1 Very True	2 True	3 Sort of True	4 Not Very True	5 Not At All True
DURING CLASS:					
42. I volunteer to answer questions about word problems in math class because it helps me understand the math.	1		ILG		5
43. If I understand a word problem my teacher is explaining, it is because I am trying as hard as I can.	1		ISC		5
44. I get bored when other students are working word problems on the board in math class.	1		interest		5
45. The next time my math teacher explains a word problem to the class, I expect to understand because I always listen carefully.	1		ISC		5
46. If I correctly answer a question the teacher asks about a word problem, it is because the teacher picks good problems.	1		ESU		5
47. Because I pay attention, I know I will be able to understand the word problems my teacher explains in class.	1		ISC		5
48. If my math teacher asks me to solve a word problem on the board, I am sure I will get the wrong answer.	1		confidence		5
49. I like to do new word problems by myself, even before the teacher explains them.	1		interest		5

WITH OTHER STUDENTS

Think about solving a word problem with a group of other students. If you have never solved a word problem with other students, imagine what it would be like. What do you do before beginning to work, as you work and after you are done? Try to think of exactly what you do. How true is each statement for you? Circle your answer.

1	2	3	4	5
Very True	True	Sort of True	Not Very True	Not At All True

BEFORE BEGINNING TO SOLVE A WORD PROBLEM WITH OTHER STUDENTS:

1. I make sure I have all the materials I will need.	1	self reg	5
2. I try to work the problem by myself first.	1	self reg	5
3. I think about how long it will take us so we can plan our time.	1	self reg	5
4. I say to the other students what I think the problem is asking.	1	self reg	5
5. I say to the other students how the problem is like other problems I have worked.	1	self reg	5
6. I say to the other students what I think we should do first.	1	self reg	5
7. I say to the other students what information we need to use to work the problem.	1	self reg	5

	1 Very True	2 True	3 Sort of True	4 Not Very True	5 Not At All True
WHILE WORKING A WORD PROBLEM WITH OTHER STUDENTS:					
8. I say to the other students if I think something should be worked differently.	1		self reg		5
9. I talk to the other students about how other problems are like the one we are working on.	1		self reg		5
10. I ask the other students questions about the problem.	1		self reg		5
11. I explain to the other students why I think my answer or procedure is right.	1		self reg		5
12. I encourage the other students to work on the problem too.	1		self reg		5
13. I listen carefully to what everyone says about the problem.	1		self reg		5
14. I keep looking back at the problem to make certain we are doing what we need to do.	1		self reg		5
15. I keep track of what everyone says.	1		self reg		5
AFTER DOING A WORD PROBLEM WITH OTHER STUDENTS:					
16. We check each other's ideas.	1		self reg		5
17. I look over all the work we did to see if we used the right procedures.	1		self reg		5
18. I check to see if our calculations are right.	1		self reg		5
19. I ask the other students whether anyone thinks the answer is wrong.	1		self reg		5
20. I say to the other students whether I think the answer makes sense.	1		self reg		5
21. I ask the other students if anyone has a different way to solve the problem.	1		self reg		5
22. I know if I learned ways to do the word problem.	1		self reg		5
23. I know if I will be able to solve word problems like this.	1		self reg		5

WITH OTHER STUDENTS

What do you think and feel about doing word problems with other students? How true is each statement for you? Circle your answer.

1 Very True	2 True	3 Sort of True	4 Not Very True	5 Not At All True

24.	If I worked with other students, I am sure I could solve most math word problems.	1	confidence	5
25.	I dread the thought of trying to solve a math word problem with other students.	1	anxiety	5
26.	If I solve a word problem working with other students, it is because we think mathematically.	1	ISU	5
27.	I have no confidence in my ability to solve a word problem with other students.	1	confidence	5
28.	If I could not solve a word problem with others students, I would have no idea why we could not solve it.	1	unkn control	5
29.	I would work hard on a word problem with other students because it would help me understand how to do the problems.	1	ILG	5
30.	I think it would be interesting to work on a math word problem with other students.	1	interest	5
31.	I feel comfortable when I work on a word problem with other students.	1	anxiety	5
32.	If I work with other students on a word problem I see how useful math is.	1	value	5
33.	I would work hard on a word problem with other students if I could learn more math that way.	1	ILG	5

	1 Very True	2 True	3 Sort of True	4 Not Very True	5 Not At All True
WITH OTHER STUDENTS:					
34. If I cannot solve a word problem with other students, it is because we did not try as hard as we could on the problem.			1 ISC		5
35. If I cannot solve a math word problem with a group of students, it is because the problem is too long.			1 ESU		5
36. I would find math interesting if I worked on a word problem with a group of students.			1 interest		5
37. I would work on a word problem with other students only if my friends told me I should.			1 EPG		5
38. If I can solve a word problem with other students, it is because we have enough ability.			1 ISU		5
39. I would like to try and solve a challenging word problem with other students because I would learn a lot.			1 ILG		5
40. Word problems would not be interesting to me if I did them with a group of students.			1 interest		5
41. If I cannot solve a word problem with other students, it is because we fooled around.			1 ISC		5
42. When I solve a word problem with other students I am never sure how we solved the problem.			1 unkn control		5
43. I would work on a word problem with other students only if I could get a better math grade.			1 EPG		5
44. Word problems seem more important when I am working hard on them with other students.			1 value		5

1 Very True	2 True	3 Sort of True	4 Not Very True	5 Not At All True

WITH OTHER STUDENTS:

45. If I cannot solve a math word problem with a group of students, it is because the teacher did not give us a problem like that before.	1	ESU		5
46. If I worked a word problem with other students, I would see that the problem is a waste of time.	1	value		5
47. If I could solve a word problem with other students, I would not know why we got it right.	1	unkn control		5
48. If I worked on a word problem with other students, I know I would be able to help to solve the problem.	1	confidence		5
49. If I cannot solve a word problem working with other students, it is because we were careless.	1	ISC		5
50. If I cannot solve a math word problem with a group of students, it is because the problem was hard.	1	ESU		5
51. I feel nervous when I work on a word problem with other students.	1	anxiety		5
52. If I solve a word problem working with other students, it is because we are smart.	1	ISU		5
53. I would work on a word problem with other students only if I was told to by my teacher.	1	EPG		5

54. How often do you work word problems with other students? Check the box with your answer.

[__] 4 or more times a week

[__] 2-3 times a week

[__] once a week

[__] less than once a week

[__] I've never worked with other students

HOMEWORK

Think about when you work word problems for homework. What do you do before you begin, as you work and after you are done? How true is each statement for you? Circle your answer.

1	2	3	4	5
Very True	True	Sort of True	Not Very True	Not At All True

BEFORE YOU BEGIN TO WORK THE HOMEWORK WORD PROBLEMS:

1. I decide when is the best time to do my math homework word problems.	1	self reg	5
2. I decide how much time to spend on my math homework word problems.	1	self reg	5
3. I make sure I have all the materials I need.	1	self reg	5

WHILE WORKING THE HOMEWORK WORD PROBLEMS:

4. I read each problem carefully.	1	self reg	5
5. I keep track of my work as I am doing a homework word problem.	1	self reg	5
6. I make sure I try every problem, even if I cannot solve them all.	1	self reg	5

AFTER WORKING THE HOMEWORK WORD PROBLEMS:

7. If I cannot do the word problems, I write out all the steps I can do and bring them to class.	1	self reg	5
8. If I do not understand the homework word problems, I ask the teacher to explain them.	1	self reg	5
9. I review my homework word problems before class.	1	self reg	5

HOMEWORK

Think about when you work word problems for homework. What do you think and feel? How true is each statement for you? Circle your answer.

1 Very True	2 True	3 Sort of True	4 Not Very True	5 Not At All True

10.	If I am not able to do my next math homework word problems, it is because I am not clever in math.	1	ISU		5
11.	When I cannot do my math homework word problems, I usually do not know why.	1	unkn control		5
12.	I do not see any use for the word problems I get for homework.	1	value		5
13.	I never expect to be able to do the types of word problems I get for math homework.	1	confidence		5
14.	The only reason I would do extra homework problems is if I could get extra credit.	1	EPG		5
15.	I do not like to do word problems for homework unless I can learn something new by doing them.	1	ILG		5
16.	I will not be able to do my next homework word problems because I do not have the ability to do them.	1	ISU		5
17.	If I am able to do word problems for homework, it is because I listen in class.	1	ISC		5
18.	I like working on math homework word problems.	1	interest		5
19.	I feel nervous when I think about doing hard word problems for homework.	1	anxiety		5
20.	Being good at solving homework word problems which involve math or reasoning mathematically is very important to me.	1	value		5
21.	I will not be able to do word problems for homework unless the problems are easy.	1	ESU		5

	1 Very True	2 True	3 Sort of True	4 Not Very True	5 Not At All True
HOMEWORK:					
22. I have a lot of confidence that I can do homework word problems.				1 confidence	5
23. I like to do hard homework word problems because I learn more math by working them.				1 ILG	5
24. If I get homework word problems right, I usually do not know why.				1 unkn control	5
25. If I can do the word problems I get for homework, it is because I spend enough time on them.				1 ISC	5
26. I feel relaxed when I am doing math word problems at home.				1 anxiety	5
27. If I am unable to do homework word problems, it is because the math book is confusing.				1 ESU	5
28. The math word problems I get for homework are interesting to me.				1 interest	5
29. I would do challenging math word problems for homework if I could get a better grade.				1 EPG	5
30. I usually do not understand why I get word problems for homework wrong.				1 unkn control	5
31. I like to do challenging word problems for homework because solving them helps me learn math.				1 ILG	5
32. If I cannot do homework word problems, it is because the problems are confusing.				1 ESU	5
33. The only reason I do my math homework word problems is because my math teacher tells me I have to.				1 EPG	5
34. Working on word problems for homework is very boring.				1 interest	5

1 Very True	2 True	3 Sort of True	4 Not Very True	5 Not At All True

HOMEWORK:

35. I do not have any confidence when it comes to doing word problems for homework.	1	confidence	5
36. Doing word problems for homework does not make me nervous.	1	anxiety	5
37. I know I can do word problems for homework because I work hard on them.	1	ISC	5
38. If I cannot do math homework word problems, it is because I am not smart enough.	1	ISU	5
39. Being able to solve the word problems I get for homework is not important to me.	1	value	5

Mathematics Assessment Questionnaire: A Survey of Thoughts and Feelings, for Students in Grades 7-9

School: TOTAL (Grades 7, 8)

Question Id	Grade Seven (N=600)								Grade Eight (N=602)							
	No		Maybe		Yes		Missing		No		Maybe		Yes		Missing	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
WORKING A MATH PROBLEM																
Before You Begin																
MET1	49	8	47	8	500	84	4	1	42	7	34	6	520	87	6	1
MET2	93	16	100	17	397	67	10	2	88	15	92	15	415	70	7	1
MET3	247	42	84	14	259	44	10	2	259	43	87	15	250	42	6	1
MET4	309	52	97	16	185	31	9	2	361	60	71	12	165	28	5	1
MET5	36	6	57	10	500	84	7	1	62	10	74	12	460	77	6	1
MET6	313	53	113	19	167	28	7	1	386	65	83	14	124	21	9	1
MET7	235	40	72	12	282	48	11	2	203	34	62	10	326	55	11	2
As You Work																
MET8	73	12	81	14	435	74	11	2	75	13	76	13	444	75	7	1
MET9	81	14	56	9	454	77	9	2	71	12	56	9	468	79	7	1
MET10	190	32	116	20	282	48	12	2	205	35	131	22	258	43	8	1
MET11	130	22	102	17	359	61	9	2	128	21	104	17	365	61	7	1
After You Finish																
MET12	92	15	89	15	413	70	6	1	108	18	98	16	391	66	7	1
MET13	101	17	91	15	401	68	7	1	114	19	78	13	401	68	9	1
MET14	162	27	86	15	345	58	7	1	193	32	94	16	307	52	8	1
MET15	91	15	77	13	425	72	7	1	134	22	100	17	362	61	6	1
MET16	385	65	90	15	118	20	7	1	430	72	74	12	90	15	8	1
Strategies Used																
MET17	205	35	30	5	359	60	6	1	108	18	28	5	461	77	5	1
MET18	447	77	59	10	77	13	17	3	497	84	56	9	40	7	9	1
MET19	112	19	91	15	385	65	12	2	162	27	103	17	327	55	10	2
MET20	344	58	122	21	123	21	11	2	429	72	100	17	64	11	9	1

School: TOTAL (Grades 7, 8)

Question Id	Grade Seven (N=600) Very True N	%	True N	%	Sort Of True N	%	Not Very True N	%	Not At All True N	%	Missing N	%	Grade Eight (N=602) Very True N	%	True N	%	Sort Of True N	%	Not Very True N	%	Not At All True N	%	Missing N	%
DURING CLASS																								
Beginning of Lesson																								
DURING1	159	27	232	39	182	30	20	3	6	1	1	0	155	26	222	37	191	32	25	4	7	1	2	0
DURING2	175	29	218	36	138	23	46	8	21	4	2	0	158	26	227	38	144	24	45	8	25	4	3	0
DURING3	206	35	202	34	146	24	29	5	14	2	3	1	171	29	215	36	173	29	31	5	10	2	2	0
DURING4	294	49	193	32	83	14	18	3	9	2	3	1	277	46	209	35	90	15	14	2	8	1	8	1
DURING5	290	48	187	31	79	13	28	5	14	2	2	0	312	52	184	31	76	13	22	4	7	1	1	0
DURING6	271	45	212	35	78	13	27	5	10	2	2	0	263	44	225	38	81	14	22	4	7	1	4	1
During Lesson																								
DURING7	137	23	225	38	146	24	57	10	33	6	2	0	131	22	175	29	180	30	69	12	45	8	2	0
DURING8	39	7	90	15	208	35	149	25	109	18	5	1	39	7	71	12	216	36	163	27	108	18	5	1
DURING9	222	37	251	42	94	16	17	3	14	2	2	0	193	32	277	46	91	15	17	3	19	3	5	1
DURING10	251	42	242	41	66	11	26	4	11	2	4	1	270	45	241	40	66	11	10	2	11	2	4	1
DURING11	162	27	135	23	135	23	73	12	91	15	4	1	158	26	132	22	157	26	84	14	67	11	4	1
DURING12	206	35	153	26	113	19	58	10	65	11	5	1	232	39	159	27	129	22	52	9	26	4	4	1
DURING13	86	14	100	17	130	22	118	20	160	27	6	1	90	15	101	17	139	23	123	21	147	25	2	0
DURING14	126	21	167	28	141	24	88	15	66	11	12	2	104	17	155	26	172	29	95	16	73	12	3	0
End of Lesson																								
DURING15	189	32	221	37	105	18	44	7	38	6	3	1	174	29	213	35	132	22	47	8	35	6	1	0
DURING16	152	26	223	38	121	20	58	10	39	7	7	1	157	26	189	32	164	27	48	8	40	7	4	1
DURING17	139	23	218	37	130	22	68	11	40	7	5	1	172	29	210	35	135	23	53	9	29	5	3	0
DURING18	118	20	174	29	134	23	95	16	74	12	5	1	111	19	137	23	195	33	92	15	63	11	4	1
DURING19	110	18	220	37	172	29	50	8	43	7	5	1	115	19	208	35	174	29	59	10	43	7	3	0

School: TOTAL (Grades 7, 8)

Question Id	Grade Seven (N=600)												Grade Eight (N=602)											
	Very True		True		Sort Of True		Not Very True		Not At All True		Missing		Very True		True		Sort Of True		Not Very True		Not At All True		Missing	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
DURING CLASS Other Thoughts and Feelings																								
DURING20	163	27	214	36	146	25	47	8	24	4	6	1	131	22	199	33	180	30	67	11	20	3	5	1
DURING21	61	10	101	17	83	14	111	19	229	39	15	3	27	5	59	10	111	19	139	24	255	43	11	2
DURING22	200	34	184	31	126	21	53	9	25	4	12	2	173	29	202	34	146	25	49	8	19	3	13	2
DURING23	172	29	134	23	144	25	50	9	85	15	15	3	129	22	134	23	170	29	73	12	87	15	9	1
DURING24	125	21	164	28	137	23	70	12	91	16	13	2	118	20	130	22	180	30	78	13	88	15	8	1
DURING25	38	6	45	8	73	13	135	23	292	50	19	3	23	4	35	6	68	12	158	27	308	52	12	2
DURING26	88	15	75	13	120	20	100	17	205	35	12	2	93	16	55	9	144	24	107	18	197	33	6	1
DURING27	90	15	68	12	121	21	100	17	207	35	14	2	67	11	66	11	111	19	121	20	230	39	7	1
DURING28	262	44	181	31	97	16	27	5	23	4	10	2	227	38	199	34	124	21	23	4	21	4	8	1
DURING29	73	12	54	9	133	23	156	26	175	30	9	2	51	9	66	11	111	19	198	33	170	29	6	1
DURING30	129	22	146	25	140	24	89	15	87	15	9	2	95	16	120	20	180	30	110	18	93	16	4	1
DURING31	59	10	90	15	96	16	156	27	181	31	16	3	35	6	76	13	119	20	184	31	178	30	10	2
DURING32	189	32	173	29	167	28	39	7	21	4	11	2	167	28	199	33	165	28	45	8	22	4	4	1
DURING33	30	5	44	8	95	16	143	24	272	47	16	3	25	4	35	6	90	15	170	29	276	46	6	1
DURING34	147	25	150	26	180	31	66	11	42	7	15	3	106	18	132	22	194	33	108	18	56	9	6	1
DURING35	129	22	147	25	140	24	79	14	89	15	16	3	116	19	135	23	155	26	95	16	94	16	7	1
DURING36	251	43	181	31	87	15	30	5	31	5	20	3	277	47	166	28	90	15	40	7	21	4	8	1
DURING37	115	20	125	21	172	30	101	17	70	12	17	3	99	17	122	21	178	30	121	21	69	12	13	2
DURING38	25	4	43	7	99	17	139	24	274	47	20	3	26	4	56	9	95	16	137	23	276	47	12	2
DURING39	88	15	72	12	118	20	106	18	202	34	14	2	81	14	69	12	112	19	119	20	214	36	7	1
DURING40	141	24	113	19	153	26	79	14	97	17	17	3	143	24	117	20	134	22	91	15	112	19	5	1
DURING41	118	20	142	24	144	24	102	17	85	14	11	2	76	13	145	24	189	32	109	18	79	13	4	1
DURING42	162	27	178	30	154	26	57	10	42	7	7	1	136	23	171	29	161	27	88	15	44	7	2	0
DURING43	197	33	171	29	129	22	65	11	31	5	7	1	153	26	184	31	150	25	73	12	36	6	6	1
DURING44	117	20	61	10	142	24	131	22	141	24	8	1	61	10	83	14	138	23	167	28	150	25	5	1
DURING45	129	22	193	33	186	31	56	9	27	5	9	2	102	17	197	33	193	32	86	14	19	3	5	1
DURING46	52	9	83	14	157	27	167	28	129	22	12	2	37	6	68	11	120	20	205	34	165	28	7	1
DURING47	194	33	191	32	136	23	45	8	27	5	7	1	140	24	221	37	143	24	66	11	25	4	7	1
DURING48	36	6	49	8	89	15	182	31	236	40	8	1	21	4	19	3	106	18	190	32	261	44	5	1
DURING49	127	21	125	21	148	25	100	17	92	16	8	1	137	23	130	22	108	18	131	22	94	16	2	0

Question Id	Grade Seven (N=600) Very True N	%	True N	%	Sort Of True N	%	Not Very True N	%	Not At All True N	%	Missing N	%	Grade Eight (N=602) Very True N	%	True N	%	Sort Of True N	%	Not Very True N	%	Not At All True N	%	Missing N	%
WORKING WITH OTHERS																										
Before Beginning																										
WITHO1	230	38	197	33	112	19	42	7	18	3	1	0	177	29	212	35	143	24	37	6	33	5	0	0		
WITHO2	218	36	237	40	94	16	32	5	17	3	2	0	216	36	224	37	118	20	36	6	8	1	0	0		
WITHO3	60	10	135	23	147	25	116	20	136	23	6	1	52	9	129	22	149	25	139	23	127	21	6	1		
WITHO4	89	15	158	27	141	24	98	16	110	19	6	1	114	19	189	32	135	23	91	15	67	11	6	1		
WITHO5	54	9	96	16	146	25	143	24	156	26	5	1	58	10	117	20	146	25	149	25	125	21	7	1		
WITHO6	107	18	163	27	117	20	100	17	108	18	5	1	133	22	174	29	129	21	83	14	82	14	1	0		
WITHO7	125	21	153	26	120	20	85	14	113	19	4	1	119	20	167	28	150	25	91	15	73	12	2	0		
While Working																										
WITHO8	98	16	190	32	133	22	83	14	90	15	6	1	123	21	214	36	130	22	70	12	62	10	3	0		
WITHO9	57	10	132	22	148	25	122	21	135	23	6	1	64	11	142	24	135	23	150	25	105	18	6	1		
WITHO10	88	15	158	27	141	24	90	15	116	20	7	1	98	16	205	34	144	24	73	12	78	13	6	1		
WITHO11	113	19	188	32	122	21	82	14	85	14	12	2	141	24	211	35	128	21	69	12	49	8	4	1		
WITHO12	93	16	143	24	133	23	92	16	124	21	15	3	97	16	168	28	143	24	100	17	88	15	6	1		
WITHO13	147	25	211	36	122	21	71	12	42	7	7	1	152	25	217	36	152	25	53	9	23	4	5	1		
WITHO14	204	34	198	33	112	19	50	8	29	5	7	1	189	32	235	39	107	18	49	8	19	3	3	0		
WITHO15	113	19	157	27	159	27	93	16	66	11	12	2	96	16	163	27	189	32	92	16	53	9	9	1		
After Working																										
WITHO16	132	22	178	30	120	20	72	12	91	15	7	1	151	25	188	31	130	22	75	13	54	9	4	1		
WITHO17	144	25	202	34	126	22	63	11	51	9	14	2	157	26	215	36	135	23	60	10	29	5	6	1		
WITHO18	167	28	214	36	103	17	54	9	52	9	10	2	182	30	230	38	125	21	41	7	20	3	4	1		
WITHO19	118	20	185	31	127	21	69	12	94	16	7	1	131	22	187	31	143	24	71	12	63	11	7	1		
WITHO20	109	18	181	31	132	22	79	13	89	15	10	2	135	23	187	31	134	22	84	14	56	9	6	1		
WITHO21	97	16	170	29	125	21	99	17	101	17	8	1	103	17	173	29	144	24	95	16	79	13	8	1		
WITHO22	127	22	238	40	143	24	50	9	30	5	12	2	145	25	223	38	150	26	44	7	26	4	14	2		
WITHO23	158	27	236	40	129	22	41	7	29	5	7	1	141	24	247	42	141	24	48	8	17	3	8	1		

Question Id	Grade Seven (N=600) Very True N	%	True N	%	Sort Of True N	%	Not Very True N	%	Not At All True N	%	Missing N	%	Grade Eight (N=602) Very True N	%	True N	%	Sort Of True N	%	Not Very True N	%	Not At All True N	%	Missing N	%
WORKING WITH OTHERS																								
Other Thoughts and Feelings																								
WITHO24	138	23	172	29	163	28	66	11	53	9	8	1	132	22	195	33	156	26	70	12	44	7	5	1
WITHO25	42	7	83	14	115	19	137	23	214	36	9	2	35	6	59	10	110	19	173	29	217	37	8	1
WITHO26	81	14	148	25	180	31	83	14	94	16	14	2	62	11	138	23	182	31	129	22	78	13	13	2
WITHO27	28	5	58	10	80	14	118	20	298	51	18	3	20	3	54	9	85	11	143	24	312	53	8	1
WITHO28	60	10	85	15	150	26	138	24	146	25	21	4	44	8	77	13	144	25	172	29	148	25	17	3
WITHO29	132	22	200	34	149	25	53	9	54	9	12	2	135	23	213	36	159	27	53	9	31	5	11	2
WITHO30	165	28	184	31	121	21	52	9	64	11	14	2	148	25	191	32	141	24	69	12	47	8	6	1
WITHO31	122	21	148	25	166	28	76	13	74	13	14	2	128	22	180	30	152	26	76	13	58	10	8	1
WITHO32	94	16	137	24	182	31	82	14	86	15	19	3	84	14	117	20	172	29	135	23	80	14	14	2
WITHO33	159	27	184	28	156	27	50	9	59	10	12	2	151	25	197	33	139	23	60	10	46	8	9	1
WITHO34	109	18	141	24	163	28	100	17	79	13	8	1	90	15	135	23	148	25	129	22	87	15	13	2
WITHO35	22	4	64	11	93	16	182	31	229	39	10	2	10	2	49	8	101	17	223	38	206	35	13	2
WITHO36	84	14	144	25	158	27	99	17	102	17	13	2	92	16	103	18	189	32	119	20	85	14	14	2
WITHO37	24	4	49	8	61	10	136	23	321	54	9	2	14	2	40	7	46	8	148	25	340	58	14	2
WITHO38	134	23	178	31	155	27	63	11	53	9	17	3	136	23	187	32	148	25	71	12	41	7	19	3
WITHO39	129	22	173	29	150	25	63	11	75	13	10	2	123	21	158	27	160	26	88	15	51	9	22	4
WITHO40	55	9	82	11	129	22	150	26	189	32	15	3	43	7	68	12	113	19	170	29	189	32	19	3
WITHO41	89	15	87	15	135	23	112	19	157	27	20	3	87	15	81	14	142	24	135	23	138	24	19	3
WITHO42	40	7	58	10	99	17	169	29	221	38	13	2	28	5	41	7	101	17	207	36	201	35	24	4
WITHO43	87	15	94	16	109	19	127	22	170	29	13	2	50	9	91	16	110	19	160	28	169	29	22	4
WITHO44	87	15	116	20	168	28	115	19	104	18	10	2	75	13	115	20	163	28	135	23	98	16	18	3
WITHO45	63	11	72	12	158	27	149	25	147	25	11	2	54	9	82	14	145	25	178	30	131	22	12	2
WITHO46	35	6	54	9	93	16	162	27	252	42	4	1	21	4	43	7	81	14	202	34	242	41	13	2
WITHO47	36	6	70	12	89	15	161	27	235	40	9	2	36	6	53	9	90	15	179	31	227	39	17	3
WITHO48	129	22	196	33	161	27	65	11	39	7	10	2	133	23	197	34	189	32	44	8	22	4	17	3
WITHO49	59	10	82	14	137	23	148	25	157	27	17	3	44	8	76	13	160	27	164	28	138	24	20	3
WITHO50	55	9	99	17	173	29	134	23	126	21	13	2	43	7	101	17	197	34	147	25	98	17	16	3
WITHO51	47	8	53	9	113	19	144	24	232	39	11	2	36	6	65	11	84	14	140	24	259	44	18	3
WITHO52	89	15	128	22	181	31	109	18	84	14	9	2	82	14	123	21	190	33	119	20	69	12	19	3
WITHO53	97	16	111	19	130	22	126	21	132	22	4	1	74	13	120	20	138	23	129	22	130	22	11	2

Question Id	4 /Week N	%	2-3 /Week N	%	1 /Week N	%	< 1 /Week N	%	Never N	%	Missing N	%	4 /Week N	%	2-3 /Week N	%	1 /Week N	%	< 1 /Week N	%	Never N	%	Missing N	%
WORKING IN A GROUP																								
INGRP	39	7	102	18	81	14	128	22	220	39	30	5	40	7	95	17	57	10	197	34	185	32	28	5

Question Id	Grade Seven (N=600)												Grade Eight (N=602)											
	Very True		True		Sort Of True		Not Very True		Not At All True		Missing		Very True		True		Sort Of True		Not Very True		Not At All True		Missing	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
HOMEWORK Before Beginning																								
HOMEWK1	183	31	156	26	108	18	67	11	87	15	1	0	170	28	165	28	117	20	67	11	80	13	3	0
HOMEWK2	107	18	137	23	88	15	122	20	144	24	2	0	87	15	124	21	112	19	125	21	147	25	7	1
HOMEWK3	239	40	178	30	105	18	40	7	35	6	3	1	209	35	183	31	123	21	44	7	39	7	4	1
While Working																								
HOMEWK4	283	47	191	32	85	14	23	4	14	2	4	1	292	49	215	36	66	11	10	2	15	3	4	1
HOMEWK5	227	38	238	40	83	14	29	5	22	4	1	0	237	40	234	39	92	15	24	4	12	2	3	0
HOMEWK6	244	41	213	36	94	16	28	5	17	3	4	1	239	40	220	37	89	15	28	5	23	4	3	0
After Working																								
HOMEWK7	109	18	140	24	151	25	91	15	104	17	5	1	106	18	145	24	144	24	107	18	94	16	6	1
HOMEWK8	166	28	190	32	142	24	53	9	49	8	0	0	172	29	201	34	133	22	59	10	32	5	5	1
HOMEWK9	82	14	123	21	139	23	111	19	144	24	1	0	70	12	101	17	166	28	132	22	129	22	4	1

Question Id	Grade Seven (N=600)												Grade Eight (N=602)											
	Very True		True		Sort Of True		Not Very True		Not At All True		Missing		Very True		True		Sort Of True		Not Very True		Not At All True		Missing	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
HOMEWORK Other Thoughts and Feelings																								
HOMEWK10	40	7	56	9	88	15	147	25	266	45	3	1	31	5	48	8	93	16	194	33	227	38	9	1
HOMEWK11	45	8	77	13	140	24	154	26	178	30	6	1	29	5	67	11	164	28	165	28	167	28	10	2
HOMEWK12	64	11	62	11	121	21	117	20	226	38	10	2	54	9	61	10	123	21	167	29	179	31	18	3
HOMEWK13	39	7	60	10	104	18	138	23	251	42	8	1	27	5	64	11	109	19	169	29	219	37	14	2
HOMEWK14	141	24	106	18	129	22	97	16	120	20	7	1	148	25	122	21	131	22	87	15	103	17	11	2
HOMEWK15	99	17	117	20	155	26	108	18	118	20	3	1	84	14	120	20	159	27	124	21	103	17	12	2
HOMEWK16	24	4	56	9	58	10	143	24	313	53	6	1	24	4	56	10	71	12	168	29	269	46	14	2
HOMEWK17	176	30	199	33	141	24	54	9	26	4	4	1	149	25	192	32	181	30	47	8	25	4	8	1
HOMEWK18	70	12	105	18	192	32	97	16	129	22	7	1	75	13	103	17	158	27	106	18	150	25	10	2
HOMEWK19	61	10	71	12	142	24	132	22	184	31	10	2	46	8	57	10	134	23	144	24	210	36	11	2
HOMEWK20	116	19	158	27	195	33	73	12	53	9	5	1	114	19	158	27	193	32	69	12	60	10	8	1
HOMEWK21	31	5	48	8	77	13	167	28	272	46	5	1	36	6	52	9	72	12	181	31	251	42	10	2
HOMEWK22	204	34	198	33	134	22	34	6	27	5	3	1	178	30	195	33	160	27	46	8	20	3	3	0
HOMEWK23	122	21	136	23	155	26	78	13	104	17	5	1	112	19	130	22	160	27	107	18	87	15	6	1
HOMEWK24	43	7	75	13	67	11	146	25	259	44	10	2	27	5	53	9	83	11	193	33	258	43	10	2
HOMEWK25	124	21	191	32	172	29	64	11	40	7	9	2	116	19	173	29	192	32	72	12	42	7	7	1
HOMEWK26	151	25	172	29	140	23	67	11	67	11	3	1	144	24	175	29	158	27	65	11	53	9	7	1
HOMEWK27	46	8	84	14	150	25	149	25	161	27	10	2	43	7	76	13	174	29	169	29	128	22	12	2
HOMEWK28	82	14	114	19	169	28	115	19	114	19	6	1	67	11	107	18	189	32	132	22	100	17	7	1
HOMEWK29	143	24	137	23	141	24	87	15	83	14	9	2	128	22	143	24	131	22	113	19	76	13	11	2
HOMEWK30	50	8	92	16	136	23	168	28	144	24	10	2	37	6	69	12	156	26	161	27	170	29	9	1
HOMEWK31	115	19	152	26	156	27	84	14	81	14	10	2	101	17	149	25	172	29	102	17	64	11	14	2
HOMEWK32	69	12	127	21	184	31	114	19	99	17	7	1	74	13	110	19	219	37	115	19	72	12	12	2
HOMEWK33	104	17	101	17	147	25	113	19	130	22	5	1	96	16	113	19	148	25	116	19	122	21	7	1
HOMEWK34	130	22	85	14	172	29	115	19	94	16	4	1	127	21	95	16	165	28	119	20	89	15	7	1
HOMEWK35	40	7	47	8	86	14	153	26	270	45	4	1	44	7	42	7	76	13	173	29	265	44	2	0
HOMEWK36	185	31	189	32	89	15	60	10	73	12	4	1	205	34	172	29	106	18	67	11	52	9	0	0
HOMEWK37	128	22	178	30	193	33	53	9	33	6	15	3	113	19	174	29	229	38	60	10	20	3	6	1
HOMEWK38	23	4	35	6	86	11	159	27	311	52	6	1	20	3	38	6	83	11	183	31	296	49	2	0
HOMEWK39	85	14	61	10	93	16	121	20	236	40	4	1	60	10	53	9	96	16	165	28	222	37	6	1

Grade Nine (N=535)

Question Id	No N	No %	Maybe N	Maybe %	Yes N	Yes %	Missing N	Missing %
WORKING A MATH PROBLEM								
Before You Begin								
MET1	29	5	29	5	477	89	0	0
MET2	64	12	111	21	354	67	6	1
MET3	225	42	72	14	234	44	4	1
MET4	330	62	68	13	133	25	4	1
MET5	40	8	66	12	424	80	5	1
MET6	300	56	106	20	125	24	4	1
MET7	150	28	67	13	311	59	7	1
As You Work								
MET8	72	14	61	12	393	75	9	2
MET9	55	10	49	9	425	80	6	1
MET10	186	35	101	19	239	45	9	2
MET11	88	17	107	20	338	63	2	0
After You Finish								
MET12	80	15	93	17	359	67	3	1
MET13	84	16	74	14	372	70	5	1
MET14	175	33	95	18	259	49	6	1
MET15	97	18	81	15	349	66	8	1
MET16	374	71	67	13	88	17	6	1
Strategies Used								
MET17	128	24	31	6	372	70	4	1
MET18	432	83	52	10	39	7	12	2
MET19	122	23	99	19	303	58	11	2
MET20	353	67	96	18	76	14	10	2

Grade Nine (N=535)

Question Id	Very True N	Very True %	True N	True %	Sort Of True N	Sort Of True %	Not Very True N	Not Very True %	Not At All True N	Not At All True %	Missing N	Missing %
DURING CLASS												
Beginning of Lesson												
DURING1	123	23	194	36	187	35	22	4	6	1	3	1
DURING2	130	25	194	37	141	27	48	9	17	3	5	1
DURING3	143	27	190	36	170	32	26	5	5	1	1	0
DURING4	209	39	202	38	89	17	23	4	8	2	4	1
DURING5	247	46	192	36	62	12	22	4	10	2	2	0
DURING6	224	42	224	42	55	10	18	3	11	2	3	1
During Lesson												
DURING7	101	19	179	34	160	30	67	13	27	5	1	0
DURING8	21	4	66	12	167	31	173	32	106	20	2	0
DURING9	151	28	241	45	107	20	20	4	13	2	3	1
DURING10	202	38	241	45	74	14	12	2	4	1	2	0
DURING11	135	25	126	24	124	23	81	15	69	13	0	0
DURING12	160	30	142	27	128	24	60	11	44	8	1	0
DURING13	51	10	72	14	112	21	124	23	172	32	4	1
DURING14	89	17	111	21	167	31	93	18	71	13	4	1
End of Lesson												
DURING15	189	32	183	34	118	22	36	7	29	5	0	0
DURING16	138	26	188	35	133	25	49	9	26	5	1	0
DURING17	128	24	187	35	122	23	67	13	30	6	1	0
DURING18	94	18	145	27	142	27	83	16	70	13	1	0
DURING19	98	18	178	33	161	30	62	12	34	6	2	0

School: TOTAL (Grade 9)

Grade Nine (N=535)

Question Id	Very True N	Very True %	True N	True %	Sort Of True N	Sort Of True %	Not Very True N	Not Very True %	Not At All True N	Not At All True %	Missing N	Missing %
DURING CLASS Other Thoughts and Feelings												
DURING20	93	17	153	29	193	36	60	11	33	6	3	1
DURING21	33	6	65	12	95	18	137	26	191	37	14	3
DURING22	145	27	190	36	132	25	32	6	29	5	7	1
DURING23	88	17	113	21	157	30	80	15	91	17	6	1
DURING24	70	13	111	21	172	32	95	18	82	15	5	1
DURING25	18	3	32	6	73	14	148	28	252	48	12	2
DURING26	99	19	69	13	125	24	114	21	124	23	4	1
DURING27	62	12	66	12	118	22	101	19	185	35	3	1
DURING28	182	35	165	31	128	24	42	8	10	2	8	1
DURING29	55	10	45	8	129	24	181	34	121	23	4	1
DURING30	75	14	118	22	144	27	124	23	73	14	1	0
DURING31	37	7	64	12	145	27	162	30	125	23	2	0
DURING32	132	25	192	36	142	27	43	8	21	4	5	1
DURING33	25	5	52	10	88	17	185	35	181	34	4	1
DURING34	71	13	138	26	148	28	122	23	50	9	6	1
DURING35	71	13	109	21	149	28	110	21	90	17	6	1
DURING36	253	48	141	27	83	16	31	6	19	4	8	1
DURING37	89	17	107	20	157	30	113	21	61	12	8	1
DURING38	33	6	54	10	109	21	133	25	199	38	7	1
DURING39	73	14	52	10	122	23	111	21	173	33	4	1
DURING40	145	27	134	25	125	24	75	14	52	10	4	1
DURING41	60	11	123	23	187	35	111	21	50	9	4	1
DURING42	98	18	157	30	177	33	69	13	31	6	3	1
DURING43	148	28	179	34	125	24	66	12	12	2	5	1
DURING44	71	13	77	15	129	24	153	29	98	19	7	1
DURING45	91	17	153	29	184	35	83	16	18	3	6	1
DURING46	26	5	60	11	131	25	180	34	126	24	10	2
DURING47	127	24	176	33	148	28	52	10	23	4	9	2
DURING48	20	4	33	6	99	19	190	36	189	36	4	1
DURING49	74	14	106	20	118	22	120	23	113	21	4	1

Grade Nine (N=535)

Question Id	Very True N	Very True %	True N	True %	Sort Of True N	Sort Of True %	Not Very True N	Not Very True %	Not At All True N	Not At All True %	Missing N	Missing %
WORKING WITH OTHERS												
Before Beginning												
WITHO1	160	30	198	37	122	23	36	7	18	3	1	0
WITHO2	176	33	214	40	93	18	32	6	16	3	4	1
WITHO3	42	8	90	17	136	26	150	28	112	21	5	1
WITHO4	84	16	162	31	133	25	84	16	66	12	6	1
WITHO5	27	5	104	20	142	27	146	27	114	21	2	0
WITHO6	95	18	172	32	105	20	83	16	77	14	3	1
WITHO7	92	17	163	31	126	24	82	15	71	13	1	0
While Working												
WITHO8	84	16	193	36	129	24	73	14	54	10	2	0
WITHO9	41	8	123	23	148	28	124	23	96	18	3	1
WITHO10	77	14	176	33	141	27	76	14	62	12	3	1
WITHO11	106	20	208	39	102	19	74	14	43	8	2	0
WITHO12	91	17	142	27	117	22	98	18	83	16	4	1
WITHO13	106	20	222	42	122	23	48	9	32	6	5	1
WITHO14	150	28	214	40	99	19	47	9	23	4	2	0
WITHO15	73	14	148	28	151	29	91	17	62	12	10	2
After Working												
WITHO16	103	19	195	37	111	21	66	12	58	11	2	0
WITHO17	122	23	213	40	128	24	47	9	21	4	4	1
WITHO18	138	26	248	47	88	17	44	8	13	2	4	1
WITHO19	85	16	200	38	115	22	83	16	48	9	4	1
WITHO20	75	14	209	39	133	25	70	13	46	9	2	0
WITHO21	67	13	162	31	125	24	99	19	76	14	6	1
WITHO22	92	18	206	39	151	29	47	9	28	5	11	2
WITHO23	112	21	217	41	139	26	40	8	20	4	7	1

Grade Nine (N=535)

Question Id	Very True N	Very True %	True N	True %	Sort Of True N	Sort Of True %	Not Very True N	Not Very True %	Not At All True N	Not At All True %	Missing N	Missing %
WORKING WITH OTHERS												
Other Thoughts and Feelings												
WITHO24	114	21	176	33	140	26	63	12	40	8	2	0
WITHO25	27	5	51	10	94	18	166	32	187	36	10	2
WITHO26	43	8	128	24	166	31	122	23	68	13	8	1
WITHO27	23	4	42	8	71	13	156	29	238	45	5	1
WITHO28	38	7	70	13	156	30	127	24	134	26	10	2
WITHO29	108	20	206	39	137	26	49	9	30	6	7	1
WITHO30	118	22	178	34	120	23	70	13	42	8	7	1
WITHO31	101	19	167	31	147	28	80	15	37	7	3	1
WITHO32	55	10	99	19	176	33	137	26	65	12	3	1
WITHO33	134	25	167	31	135	25	56	11	39	7	4	1
WITHO34	70	13	122	23	168	32	115	22	57	11	3	1
WITHO35	16	3	48	9	86	16	211	40	170	32	4	1
WITHO36	77	15	102	19	152	29	112	21	86	16	6	1
WITHO37	14	3	28	5	45	8	145	27	298	56	5	1
WITHO38	91	17	200	38	140	27	49	9	42	8	13	2
WITHO39	98	19	157	30	143	27	82	16	49	9	6	1
WITHO40	41	8	52	10	108	20	172	33	156	29	6	1
WITHO41	66	13	75	14	160	30	115	22	110	21	9	2
WITHO42	21	4	45	9	111	21	170	32	179	34	9	2
WITHO43	68	13	64	12	131	25	128	24	135	26	9	2
WITHO44	57	11	90	17	153	29	135	25	95	18	5	1
WITHO45	35	7	62	12	179	34	154	29	99	19	6	1
WITHO46	28	5	53	10	67	13	187	35	195	37	7	1
WITHO47	30	6	58	11	83	16	155	29	200	38	9	2
WITHO48	102	19	199	38	153	29	47	9	25	5	9	2
WITHO49	34	6	87	16	139	26	164	31	106	20	5	1
WITHO50	49	9	99	19	164	31	130	25	86	16	7	1
WITHO51	31	6	44	8	101	19	142	27	211	40	6	1
WITHO52	59	11	93	18	193	37	110	21	69	13	11	2
WITHO53	79	15	109	21	117	22	121	23	104	20	5	1

Question Id	4 /Week N	4 /Week %	2-3 /Week N	2-3 /Week %	1 /Week N	1 /Week %	< 1 /Week N	< 1 /Week %	Never N	Never %	Missing N	Missing %
WORKING IN A GROUP												
INGRP	35	7	78	15	55	10	170	32	191	36	6	1

Grade Nine (N=535)

Question Id	Very True		True		Sort Of True		Not Very True		Not At All True		Missing	
	N	%	N	%	N	%	N	%	N	%	N	%
HOMEWORK												
Before Beginning												
HOMEWK1	144	27	175	33	109	21	57	11	46	9	4	1
HOMEWK2	79	15	121	23	98	18	117	22	116	22	6	1
HOMEWK3	160	30	208	39	109	21	34	6	20	4	4	1
While Working												
HOMEWK4	246	46	205	39	66	12	11	2	4	1	3	1
HOMEWK5	197	37	233	44	68	13	18	3	14	3	5	1
HOMEWK6	189	36	214	41	82	16	24	5	17	3	9	2
After Working												
HOMEWK7	103	19	151	28	121	23	94	18	63	12	3	1
HOMEWK8	132	25	190	36	127	24	42	8	39	7	5	1
HOMEWK9	61	11	103	19	138	26	128	24	102	19	3	1

Grade Nine (N=535)

Question Id	Very True		True		Sort Of True		Not Very True		Not At All True		Missing	
	N	%	N	%	N	%	N	%	N	%	N	%
HOMEWORK Other Thoughts and Feelings												
HOMEWK10	29	5	29	5	83	16	178	33	214	40	2	0
HOMEWK11	28	5	54	10	150	28	157	30	141	27	5	1
HOMEWK12	52	10	54	10	128	24	131	25	158	30	12	2
HOMEWK13	28	5	47	9	98	19	179	34	177	34	8	1
HOMEWK14	155	29	99	19	110	21	85	16	83	16	3	1
HOMEWK15	74	14	108	20	143	27	124	23	81	15	5	1
HOMEWK16	23	4	38	7	61	12	166	31	243	46	6	1
HOMEWK17	129	24	212	40	128	24	35	7	25	5	6	1
HOMEWK18	52	10	87	13	143	27	114	22	150	29	9	2
HOMEWK19	44	8	60	11	126	24	140	26	161	30	4	1
HOMEWK20	101	19	121	23	176	34	84	16	43	8	10	2
HOMEWK21	32	6	30	6	89	17	191	36	189	36	4	1
HOMEWK22	136	26	162	31	163	31	45	8	25	5	4	1
HOMEWK23	82	16	117	22	142	27	112	21	76	14	6	1
HOMEWK24	28	5	40	8	85	16	174	33	205	39	5	1
HOMEWK25	100	19	173	33	158	30	60	11	37	7	7	1
HOMEWK26	108	20	150	28	131	25	85	16	54	10	7	1
HOMEWK27	45	9	65	12	141	27	175	33	100	19	9	2
HOMEWK28	47	9	86	16	160	30	123	23	110	21	9	2
HOMEWK29	105	20	141	27	136	26	81	16	58	11	16	3
HOMEWK30	34	6	67	13	167	32	149	28	110	21	8	1
HOMEWK31	85	16	113	21	156	30	107	20	67	13	7	1
HOMEWK32	58	11	113	21	186	35	98	19	71	13	9	2
HOMEWK33	75	14	98	19	143	27	100	19	112	21	7	1
HOMEWK34	118	22	85	16	152	29	101	19	72	14	7	1
HOMEWK35	32	6	36	7	99	19	168	32	198	37	2	0
HOMEWK36	171	32	175	33	95	18	50	9	38	7	6	1
HOMEWK37	97	19	142	27	193	37	73	14	19	4	11	2
HOMEWK38	23	4	31	6	52	10	162	31	263	50	4	1
HOMEWK39	45	9	55	10	104	20	159	30	166	31	6	1

Appendix 5-1

Statement Numbers, Scale Response Numbers for Indicators, and Interpretation of Diagnostic Indicators for Affective Belief, Motivation and Attribution Categories

	Activity Setting			
Thoughts & Feelings	During Class	Working W/Others	Homework	Interpretation
Value	26(R)[1]	32	12(R)	4 or 5
	28	44	20	indicates
	34	46(R)	39(R)	low value
Interest	24	30	18	4 or 5
	44(R)	36	28	indicates
	49	40(R)	34(R)	low interest
Confidence	20	24	13(R)	4 or 5
	31(R)	27(R)	22	indicates
	48(R)	48	35(R)	low confidence
Anxiety	27	25	19	1 or 2
	35(R)	31(R)	26(R)	indicates
	39	51	36(R)	high anxiety
Internal Learning Goals	30	29	15	4 or 5
	32	33	23	indicates not
	42	39	31	inter. motivated
External Performance Goals	25	37	14	1 or 2
	36	43	29	indicates
	40	53	33	exter. motivated
Internal Stable Uncontrollable	22	26	10	1 or 2
	37	38	16	indicates internal
	41	52	38	stable uncontrol
Internal Stable Controllable	43	34	17	4 or 5
	45	41	25	indicates internal
	47	49	37	stable uncontrol

Appendix 5-1 (continued)

External	23	35	21	1 or 2
Stable	29	45	27	indicates external
Uncontrollable	46	50	32	stable uncontrol.
Unknown	21	28	11	1 or 2
Control	33	42	24	indicates unknown
	38	47	30	sense of control.

[1]Where an (R) appears, the opposite end of a scale, the reverse is counted: e.g., for confidence a 4 or 5 indicates low confidence and the (R) next to 31 indicates that the reverse end, a 1 or 2 is counted as an indicator of low confidence.